



ALS Paragon



Gamma Spectroscopy Case Narrative

Los Alamos National Laboratory SMO

Rock -- 09-476

Work Order Number: 0812153

1. This report consists of analytical results and supporting documentation for one solid sample received by ALS Paragon on 12/16/08. This sample consists of a small rock.
2. This sample was prepared according to procedure SOP739R9. Modifications were made to the method as described on QASS 365782.
3. The sample was analyzed for the presence of gamma emitting radionuclides according to procedure SOP713R10. The analysis was completed on 12/31/08.
4. The analysis results for this sample are reported on an "As Received" basis in units of pCi/gram. This sample is a digestate.
5. Sample volume was insufficient to allow preparation of a duplicate. A duplicate analysis of sample 0812153-1 was performed in lieu of a prepared duplicate.
6. Duplicate analysis results above the DER warning limit of 1.42 have been flagged as "W" for Warning.
7. Activity concentrations above the calculated MDC are reported in some instances where minimum nuclide identification criteria are not met. Such tentative identifications result when the software attempts to calculate net activity concentrations for analytes where either one or both of the following criteria are not satisfied: the 'diagnostic' peak for a nuclide must be identified above the critical level, or the minimum library peak abundance must be attained. Nuclides not meeting these requirements have been flagged with a "TI" qualifier.
8. ALS Paragon has found there to be a significant low bias to ^{214}Pb and ^{214}Bi results when using a mixed nuclide gamma source for efficiency calibrations. The magnitude of this bias has been determined to be approximately 32% for ^{214}Bi , and 23% for ^{214}Pb . Therefore, any reported results for ^{214}Pb and ^{214}Bi are flagged with a "J" qualifier, indicating the activity values to be an estimated value. Results are reported without further qualification.

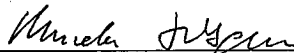


9. Technical considerations made in the creation of the gamma spectroscopy library used in this analysis are detailed in the document "Technical Comments Regarding Gamma Spectroscopy Libraries" found in Section 5.
10. The requested detection limit of 0.12 pCi/gram for ^{137}Cs was not met for samples 0812153-1, -1DUP, and the method blank, following a maximum count time of 1000 minutes. The results have been flagged with an "M" or "M3" qualifier on the final reports. The reported activity for the samples with an "M3" qualifier is greater than the achieved detection limit. Results are submitted without further qualification.
11. There are cases where the magnitude of negative activity is greater than the 2σ TPU. Under typical conditions, where background data is normally distributed and analyzed by paired observations, this event is likely to occur at least 2.5% of the time. Review of the data does not indicate a problem with the instrument or reporting systems and results are reported without further qualification.
12. No further problems were encountered with either the client sample or the associated quality control samples. All remaining quality control criteria were met.

The data contained in the following report have been reviewed and approved by the personnel listed below. In addition, ALS Paragon certifies that the analyses reported herein are true, complete and correct within the limits of the methods employed.


Linda Arend
Radiochemistry Primary Data Reviewer

01/27/09
Date


Radiochemistry Final Data Reviewer

1-27-09
Date

Radiochemistry Data Package

Section 1

CHAIN OF CUSTODY

ALS Paragon

Sample Number(s) Cross-Reference Table

Paragon OrderNum: 0812153

Client Name: Los Alamos National Laboratory SMO

Client Project Name: Rock

Client Project Number: 09-476

Client PO Number: 33204-001-06 F3

Client Sample Number	Lab Sample Number	COC Number	Matrix	Date Collected	Time Collected
CAPU-09-1656	0812153-1		SOLID	09-Dec-08	

0812153

Wednesday, December 10, 2008

LOS ALAMOS
NATIONAL LABORATORY

ATTN: Lance Steere

Paragon Analytics, Inc.
225 Commerce
Fort Collins, CO 80524

Please analyse the enclosed samples
according to the schedule indicated:

SHIP DATE: 12/10/2008

TURNAROUND/REPORT DUE: 1/9/2009

TURNAROUND REQ'D: 30 Days

RAD SCREENING: Unscreened

LAB REQUEST COMMENTS: Please Send results, invoice and questions to Keith greene at LANL.

LANL ER SMO CONTACT:

Signature:



These Samples are on:
LANL Request Number:09-476
Per Agreement Number:1-800-443-1511
Project Cost Code: WEPR13110300

PRIORITY	METHOD CODE	CNTNR	SAMPLE ID	SAMPLE MATRIX	DATE SAMPLED	SAMPLE COMMENTS	SPECIAL INSTRUCTIONS
	EPA:901.1	1	CAPU-09-1656	S	12/9/2008		
	EPA:905.0	1	CAPU-09-1656	S	12/9/2008		
	HASL-300:AM-241	1	CAPU-09-1656	S	12/9/2008		
	HASL-300:ISOPU	1	CAPU-09-1656	S	12/9/2008		
	HASL-300:ISOU	1	CAPU-09-1656	S	12/9/2008		

Final Page of REQUEST NUMBER 09-476

Wednesday, December 10, 2008

LAB CHAIN OF CUSTODY DOCUMENT NUMBER: 09-476C

REQUEST NUMBER: 09-476

LOS ALAMOS

NATIONAL LABORATORY

ATTN: Lance Steere

Paragon Analytics, Inc.

225 Commerce

Fort Collins, CO 80524

TURNAROUND/REPORT DUE: 1/9/2009

TURNAROUND REQ'D: 30

LAB REQUEST COMMENTS: Please Send results, invoice and questions to Keith greene at LANL.

SAMPLE ID	CTNR	CTNR DESC	ORDER	PRESERV	MATRIX
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① CAPU-09-1656	1	1 L POLY	AM241+GS+ISOPU+ISO U+SR90	None	S
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Relinquished By:

Date

Time

Received By:

Date

Time

M. Kaltofen		Dec. 15, 2008	10 AM	Cheryl Trimble		12-16-08	1015
Printed Name	Signature			Printed Name	Signature		

Printed Name

Signature

Printed Name

Signature

Printed Name

Signature

Printed Name

Signature

Received for DISPOSAL By:

Date

Time

Remarks:

Printed Name

Signature

CONDITION OF SAMPLE UPON RECEIPT FORM

Paragon Analytics

Client: LANLWorkorder No: 0812153Project Manager: LSInitials: CDT Date: 12-16-08

1. Does this project require any special handling in addition to standard Paragon procedures?	YES	<u>NO</u>
2. Are custody seals on shipping containers intact?	NONE	<u>YES</u> NO
3. Are Custody seals on sample containers intact?	NONE	<u>YES</u> NO
4. Is there a COC (Chain-of-Custody) present or other representative documents?		<u>YES</u> NO
5. Are the COC and bottle labels complete and legible ?	<u>YES</u>	<u>NO</u>
6. Is the COC in agreement with samples received? (IDs, dates, times, no. of samples, no. of containers, matrix, requested analyses, etc.)	<u>YES</u>	NO
7. Were airbills / shipping documents present and/or removable?	DROP OFF	<u>YES</u> NO
8. Are all aqueous samples requiring preservation preserved correctly ? (excluding volatiles)	<u>N/A</u>	YES NO
9. Are all aqueous non-preserved samples pH 4-9 ?	<u>N/A</u>	YES NO
10. Is there sufficient sample for the requested analyses?		<u>YES</u> NO
11. Were all samples placed in the proper containers for the requested analyses?		<u>YES</u> NO
12. Are all samples within holding times for the requested analyses?		<u>YES</u> NO
13. Were all sample containers received intact ? (not broken or leaking, etc.)		<u>YES</u> NO
14. Are all samples requiring no headspace (VOC, GRO, RSK/MEE, Rx CN/S, radon) headspace free? Size of bubble: <u> </u> < green pea <u> </u> > green pea	<u>N/A</u>	YES NO
15. Do perchlorate LCMS-MS samples have headspace? (at least 1/3 of container required)	<u>N/A</u>	YES NO
16. Were samples checked for and free from the presence of residual chlorine ? (Applicable when PM has indicated samples are from a chlorinated water source; note if field preservation with sodium thiosulfate was not observed.)	<u>N/A</u>	YES NO
17. Were the samples shipped on ice ?		YES <u>NO</u>
18. Were cooler temperatures measured at 0.1-6.0°C? IR gun used*: #2 #4	<u>RAD ONLY</u>	YES <u>NO</u>
Cooler #: <u>1</u>		
Temperature (°C): <u>22.8 ± 0.3</u>		
No. of custody seals on cooler: <u>3</u>		
DOT Survey/ Acceptance Information	External µR/hr reading: <u>13</u>	
	Background µR/hr reading: <u>11</u>	
Were external µR/hr readings ≤ two times background and within DOT acceptance criteria? <u>YES</u> / NO / NA (If no. see Form 008.)		

Additional Information: PROVIDE DETAILS BELOW FOR A NO RESPONSE TO ANY QUESTION ABOVE, EXCEPT #1 AND #16.

No time listed on COC or labelLimited volume: Luck ~ 1.89g.If applicable, was the client contacted? YES / NO / NA Contact: Keith G. Date/Time: 12/19/08Project Manager Signature / Date: [Signature] 12/19/08

*IR Gun #2: Oakton, SN 29922500201-0066

*IR Gun #4: Oakton, SN 2372220101-0002

Radiochemistry Data Package

Section 2

SAMPLE RESULTS SUMMARY

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Radiochemistry Data Package

Section 3

QC RESULTS SUMMARY

Gamma Spectroscopy Results

PAI 713 Rev 10

Method Blank Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Lab ID: GS081229-1MB

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 29-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 30-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Final Aliquot: 1.62 g

Result Units: pCi/g

File Name: 081787d07

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	4.9 +/- 5.6	18.4		U
14391-76-5	Ag-110m	-0.32 +/- 0.77	2.63		U
14682-66-7	Al-26	0.9 +/- 1.2	4.1		U
14596-10-2	Am-241	7.1 +/- 4.9	15.9		U
13966-02-4	Be-7	-1.7 +/- 6.2	21.0		U
14913-49-6	Bi-212	22 +/- 12	40		U
14733-03-0	Bi-214	7.9 +/- 1.9	5.8		J,TI
13982-30-4	Ce-139	-0.45 +/- 0.49	1.65		U
14762-78-8	Ce-144	2.7 +/- 3.4	11.2		U
14093-03-9	Co-56	1.0 +/- 1.5	5.0		U
13981-50-5	Co-57	0.17 +/- 0.45	1.49		U
13981-38-9	Co-58	-1.52 +/- 0.78	2.74		U
10198-40-0	Co-60	-0.56 +/- 0.98	3.41		U
14392-02-0	Cr-51	-1.5 +/- 5.5	18.6		U
13967-70-9	Cs-134	-2.18 +/- 0.89	3.06		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: GSS0812153-1

Gamma Spectroscopy Results

PAI 713 Rev 10

Method Blank Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Lab ID: GS081229-1MB

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 29-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 30-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Final Aliquot: 1.62 g

Result Units: pCi/g

File Name: 081787d07

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
10045-97-3	Cs-137	-0.96 +/- 0.85	2.93	0.12	U,M
14683-23-9	Eu-152	-1.8 +/- 5.3	18.2		U
15585-10-1	Eu-154	0.4 +/- 4.9	16.6		U
14391-16-3	Eu-155	2.9 +/- 1.3	4.1		U
14596-12-4	Fe-59	2.5 +/- 1.7	5.5		U
10043-66-0	I-131	-0.17 +/- 0.74	2.48		U
13966-00-2	K-40	62 +/- 24	76		U
13966-31-9	Mn-54	-0.23 +/- 0.88	2.99		U
13966-32-0	Na-22	-0.21 +/- 0.96	3.29		U
14681-63-1	Nb-94	-0.43 +/- 0.93	3.18		U
13967-76-5	Nb-95	0.15 +/- 0.78	2.63		U
15100-28-4	Pa-234m	280 +/- 150	490		U
15092-94-1	Pb-212	0.3 +/- 2.1	6.9		U
15067-28-4	Pb-214	-4.0 +/- 3.2	10.7		U,J
13967-48-1	Ru-106	-19.3 +/- 7.8	27.3		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: GSS0812153-1

Gamma Spectroscopy Results

PAI 713 Rev 10

Method Blank Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Lab ID: GS081229-1MB

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 29-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 30-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Final Aliquot: 1.62 g

Result Units: pCi/g

File Name: 081787d07

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14683-10-4	Sb-124	-1.65 +/- 0.89	3.05		U
14234-35-6	Sb-125	2.3 +/- 1.8	6.3		U
13967-63-0	Sc-46	0.07 +/- 0.82	2.78		U
15623-47-9	Th-227	4.4 +/- 6.3	20.8		U
15065-10-8	Th-234	22 +/- 23	81		U
14913-50-9	Tl-208	2.68 +/- 0.92	2.92		U
15117-96-1	U-235	11.7 +/- 3.6	11.2		TI
13982-39-3	Zn-65	2.2 +/- 2.0	6.5		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

M - Requested MDC not met.

B - Analyte concentration greater than MDC.

B3 - Analyte concentration greater than MDC but less than Requested MDC.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: GSS0812153-1

Gamma Spectroscopy Results

PAI 713 Rev 10

Laboratory Control Sample(s)

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Lab ID: GS081229-1LCS

Library: ANALYTICAL

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 29-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 31-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 30 minutes

Final Aliquot: 1000 ml

Result Units: pCi/g

File Name: 081790d07

CASNO	Target Nuclide	Results +/- 1s TPU	MDC	Spike Added	% Rec	Control Limits	Lab Qualifier
14596-10-2	Am-241	100.4 +/- 5.9	1.5	99.2	101	85 - 115	P
10198-40-0	Co-60	46.4 +/- 2.7	0.2	46.2	100	85 - 115	P
10045-97-3	Cs-137	40.1 +/- 2.4	0.3	37.6	107	85 - 115	P,M3

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

LT - Result is less than Requested MDC, greater than sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS Recovery within control limits.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

Data Package ID: GSS0812153-1

Date Printed: Tuesday, January 27, 2009

ALS Paragon

LIMS Version: 6.237A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Duplicate Sample Results (DER)

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1DUP

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 31-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081791d07

CASNO	Analyte	Sample Result +/- 1 s TPU	Duplicate Result +/- 1 s TPU	DER	Control Limit	Lab Qualifiers
14331-83-0	Ac-228	9.8 +/- 3.5	4.0 +/- 5.5	0.45	2.13	U
14391-76-5	Ag-110m	1.1 +/- 1.4	0.4 +/- 1.2	0.19	2.13	U
14682-66-7	Al-26	-0.5 +/- 1.0	1.0 +/- 1.2	0.49	2.13	U
14596-10-2	Am-241	12.4 +/- 8.8	7.7 +/- 5.1	0.23	2.13	U
13966-02-4	Be-7	9.4 +/- 8.3	8.9 +/- 8.6	0.02	2.13	U
14913-49-6	Bi-212	17 +/- 12	15 +/- 13	0.07	2.13	U
14733-03-0	Bi-214	1.2 +/- 4.2	9.0 +/- 3.4	0.73	2.13	U,J
13982-30-4	Ce-139	-0.11 +/- 0.67	0.36 +/- 0.57	0.27	2.13	U
14762-78-8	Ce-144	5.6 +/- 4.5	4.5 +/- 3.7	0.10	2.13	U
14093-03-9	Co-56	5.9 +/- 1.7	1.3 +/- 1.9	0.89	2.13	U
13981-50-5	Co-57	0.48 +/- 0.62	0.11 +/- 0.50	0.23	2.13	U
13981-38-9	Co-58	-1.9 +/- 1.0	0.69 +/- 0.96	0.93	2.13	U
10198-40-0	Co-60	-1.13 +/- 0.99	-0.9 +/- 1.1	0.08	2.13	U
14392-02-0	Cr-51	-6 +/- 11	3.9 +/- 10	0.34	2.13	U
13967-70-9	Cs-134	-2.26 +/- 0.95	-0.4 +/- 1.3	0.58	2.13	U
10045-97-3	Cs-137	8.3 +/- 1.2	8.2 +/- 1.2	0.02	2.13	M3
14683-23-9	Eu-152	-2.9 +/- 4.6	7.1 +/- 4.8	0.75	2.13	U

Comments:

Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

DER - Duplicate Error Ratio (see PAI SOP 715)

BDL - Below Detection Limit

NR - Not Reported

Data Package ID: GSS0812153-1

Date Printed: Tuesday, January 27, 2009

ALS Paragon

LIMS Version: 6.237A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Duplicate Sample Results (DER)

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1DUP

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 31-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081791d07

CASNO	Analyte	Sample Result +/- 1 s TPU	Duplicate Result +/- 1 s TPU	DER	Control Limit	Lab Qualifiers
15585-10-1	Eu-154	-0.8 +/- 4.9	-5.0 +/- 5.3	0.29	2.13	U
14391-16-3	Eu-155	-4.2 +/- 4.7	-0.7 +/- 2.1	0.34	2.13	U
14596-12-4	Fe-59	3.3 +/- 2.3	1.5 +/- 2.5	0.25	2.13	U
10043-66-0	I-131	-1.5 +/- 4.6	-2.2 +/- 4.8	0.06	2.13	U
13966-00-2	K-40	31 +/- 30	66 +/- 23	0.46	2.13	U
13966-31-9	Mn-54	-0.71 +/- 0.91	-2.29 +/- 0.95	0.60	2.13	U
13966-32-0	Na-22	0.1 +/- 1.0	0.2 +/- 1.0	0.03	2.13	U
14681-63-1	Nb-94	0.14 +/- 0.92	-0.18 +/- 0.96	0.12	2.13	U
13967-76-5	Nb-95	-0.51 +/- 0.94	1.3 +/- 1.0	0.63	2.13	U
15100-28-4	Pa-234m	-180 +/- 160	110 +/- 160	0.64	2.13	U
15092-94-1	Pb-212	1.9 +/- 2.3	1.8 +/- 2.2	0.02	2.13	U
15067-28-4	Pb-214	2.5 +/- 1.6	-0.9 +/- 3.3	0.46	2.13	U,J
13967-48-1	Ru-106	-4.0 +/- 8.5	-1 +/- 11	0.12	2.13	U
14683-10-4	Sb-124	0.4 +/- 1.2	5.3 +/- 1.1	1.54	2.13	W,TI
14234-35-6	Sb-125	2.7 +/- 2.2	4.8 +/- 1.7	0.38	2.13	U
13967-63-0	Sc-46	-0.66 +/- 0.98	-1.5 +/- 1.0	0.30	2.13	U
15623-47-9	Th-227	-4.7 +/- 4.1	-2.2 +/- 6.6	0.16	2.13	U

Comments:

Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

DER - Duplicate Error Ratio (see PAI SOP 715)

BDL - Below Detection Limit

NR - Not Reported

Data Package ID: GSS0812153-1

Date Printed: Tuesday, January 27, 2009

ALS Paragon

LIMS Version: 6.237A

Page 2 of 3

Gamma Spectroscopy Results

PAI 713 Rev 10

Duplicate Sample Results (DER)

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1DUP

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 31-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081791d07

CASNO	Analyte	Sample Result +/- 1 s TPU	Duplicate Result +/- 1 s TPU	DER	Control Limit	Lab Qualifiers
15065-10-8	Th-234	20 +/- 14	5 +/- 24	0.27	2.13	U
14913-50-9	Tl-208	2.40 +/- 0.93	-0.4 +/- 1.9	0.66	2.13	U
15117-96-1	U-235	5.3 +/- 4.2	0.9 +/- 6.6	0.28	2.13	U
13982-39-3	Zn-65	-3.0 +/- 2.0	-0.2 +/- 2.9	0.39	2.13	U

Comments:

Duplicate Qualifiers/Flags:

U - Result is less than the sample specific MDC.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

LT - Result is less than Request MDC, greater than sample specific MDC

M - Requested MDC not met.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

L - LCS Recovery below lower control limit.

H - LCS Recovery above upper control limit.

P - LCS, Matrix Spike Recovery within control limits.

N - Matrix Spike Recovery outside control limits

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

DER - Duplicate Error Ratio (see PAI SOP 715)

BDL - Below Detection Limit

NR - Not Reported

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS0812153-1

Date Printed: Tuesday, January 27, 2009

ALS Paragon

LIMS Version: 6.237A

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Radiochemistry Data Package



Section 4

INDIVIDUAL SAMPLE RESULTS

Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1

Library: FANP.LIB

Analysis ReqCode: Low MDA

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 30-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081979d06

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	9.8 +/- 3.5	10.9		U
14391-76-5	Ag-110m	1.1 +/- 1.4	4.6		U
14682-66-7	Al-26	-0.5 +/- 1.0	3.7		U
14596-10-2	Am-241	12.4 +/- 8.8	29.0		U
13966-02-4	Be-7	9.4 +/- 8.3	27.5		U
14913-49-6	Bi-212	17 +/- 12	39		U
14733-03-0	Bi-214	1.2 +/- 4.2	13.8		U,J
13982-30-4	Ce-139	-0.11 +/- 0.67	2.26		U
14762-78-8	Ce-144	5.6 +/- 4.5	14.9		U
14093-03-9	Co-56	5.9 +/- 1.7	5.3		TI
13981-50-5	Co-57	0.48 +/- 0.62	2.06		U
13981-38-9	Co-58	-1.9 +/- 1.0	3.6		U
10198-40-0	Co-60	-1.13 +/- 0.99	3.52		U
14392-02-0	Cr-51	-6 +/- 11	36		U
13967-70-9	Cs-134	-2.26 +/- 0.95	3.29		U

Data Package ID:

Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1

Library: FANP.LIB

Analysis ReqCode: Low MDA

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 30-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081979d06

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
10045-97-3	Cs-137	8.3 +/- 1.2	3.0	0.12	M3
14683-23-9	Eu-152	-2.9 +/- 4.6	16.2		U
15585-10-1	Eu-154	-0.8 +/- 4.9	16.8		U
14391-16-3	Eu-155	-4.2 +/- 4.7	15.8		U
14596-12-4	Fe-59	3.3 +/- 2.3	7.7		U
10043-66-0	I-131	-1.5 +/- 4.6	15.6		U
13966-00-2	K-40	31 +/- 30	98		U
13966-31-9	Mn-54	-0.71 +/- 0.91	3.16		U
13966-32-0	Na-22	0.1 +/- 1.0	3.4		U
14681-63-1	Nb-94	0.14 +/- 0.92	3.10		U
13967-76-5	Nb-95	-0.51 +/- 0.94	3.26		U
15100-28-4	Pa-234m	-180 +/- 160	550		U
15092-94-1	Pb-212	1.9 +/- 2.3	7.7		U
15067-28-4	Pb-214	2.5 +/- 1.6	5.4		U,J
13967-48-1	Ru-106	-4.0 +/- 8.5	28.9		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS0812153-1

Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1

Library: FANP.LIB

Analysis ReqCode: Low MDA

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 30-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081979d06

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14683-10-4	Sb-124	0.4 +/- 1.2	3.9		U
14234-35-6	Sb-125	2.7 +/- 2.2	7.3		U
13967-63-0	Sc-46	-0.66 +/- 0.98	3.42		U
15623-47-9	Th-227	-4.7 +/- 4.1	14.1		U
15065-10-8	Th-234	20 +/- 14	47		U
14913-50-9	Tl-208	2.40 +/- 0.93	2.98		U
15117-96-1	U-235	5.3 +/- 4.2	13.9		U
13982-39-3	Zn-65	-3.0 +/- 2.0	7.1		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU

Y1 - Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M3 - The requested MDC was not met, but the reported activity is greater than the reported MDC.

M - The requested MDC was not met.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 half-lives.

G - Sample density differs by more than 15% of LCS density.

Data Package ID: GSS0812153-1

Date Printed: Tuesday, January 27, 2009

ALS Paragon

LIMS Version: 6.237A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Duplicate Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1DUP

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 31-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081791d07

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
14331-83-0	Ac-228	4.0 +/- 5.5	18.3		U
14391-76-5	Ag-110m	0.4 +/- 1.2	4.3		U
14682-66-7	Al-26	1.0 +/- 1.2	4.1		U
14596-10-2	Am-241	7.7 +/- 5.1	16.7		U
13966-02-4	Be-7	8.9 +/- 8.6	28.6		U
14913-49-6	Bi-212	15 +/- 13	43		U
14733-03-0	Bi-214	9.0 +/- 3.4	13.5		U,J
13982-30-4	Ce-139	0.36 +/- 0.57	1.88		U
14762-78-8	Ce-144	4.5 +/- 3.7	12.2		U
14093-03-9	Co-56	1.3 +/- 1.9	6.5		U
13981-50-5	Co-57	0.11 +/- 0.50	1.66		U
13981-38-9	Co-58	0.69 +/- 0.96	3.22		U
10198-40-0	Co-60	-0.9 +/- 1.1	3.7		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: GSS0812153-1

Date Printed: Tuesday, January 27, 2009

ALS Paragon

LIMS Version: 6.237A

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Gamma Spectroscopy Results

PAI 713 Rev 10

Sample Duplicate Results

Lab Name: ALS Paragon

Work Order Number: 0812153

Client Name: Los Alamos National Laboratory SMO

ClientProject ID: Rock 09-476

Field ID: CAPU-09-1656

Lab ID: 0812153-1DUP

Library: FANP.LIB

Sample Matrix: SOLID

Prep SOP: PAI 739 Rev 9

Date Collected: 09-Dec-08

Date Prepared: 29-Dec-08

Date Analyzed: 31-Dec-08

Prep Batch: GS081229-1

QCBatchID: GS081229-1-1

Run ID: GS081229-1A

Count Time: 1000 minutes

Report Basis: As Received

Final Aliquot: 1.62 g

Prep Basis: As Received

Moisture(%): NA

Result Units: pCi/g

File Name: 081791d07

CASNO	Target Nuclide	Result +/- 1 s TPU	MDC	Requested MDC	Lab Qualifier
15100-28-4	Pa-234m	110 +/- 160	520		U
15092-94-1	Pb-212	1.8 +/- 2.2	7.3		U
15067-28-4	Pb-214	-0.9 +/- 3.3	11.0		U,J
13967-48-1	Ru-106	-1 +/- 11	37		U
14683-10-4	Sb-124	5.3 +/- 1.1	3.3		W,TI
14234-35-6	Sb-125	4.8 +/- 1.7	6.8		U
13967-63-0	Sc-46	-1.5 +/- 1.0	3.5		U
15623-47-9	Th-227	-2.2 +/- 6.6	22.0		U
15065-10-8	Th-234	5 +/- 24	80		U
14913-50-9	Tl-208	-0.4 +/- 1.9	6.4		U
15117-96-1	U-235	0.9 +/- 6.6	21.9		U
13982-39-3	Zn-65	-0.2 +/- 2.9	9.9		U

Comments:

Qualifiers/Flags:

U - Result is less than the sample specific MDC or less than the associated TPU.

Y1 - Chemical Yield is in control at 100-110%. Quantitative yield is assumed.

Y2 - Chemical Yield outside default limits.

LT - Result is less than Requested MDC, greater than sample specific MDC.

M - The requested MDC was not met.

M3 - The requested MDC was not met, but thereported activity is greater than the reported MDC.

W - DER is greater than Warning Limit of 1.42

D - DER is greater than Control Limit of 2.13

SQ - Spectral quality prevents accurate quantitation.

SI - Nuclide identification and/or quantitation is tentative.

TI - Nuclide identification is tentative.

R - Nuclide has exceeded 8 halfives.

G - Sample density differs by more than 15% of LCS density.

Abbreviations:

TPU - Total Propagated Uncertainty (see PAI SOP 743)

MDC - Minimum Detectable Concentration (see PAI SOP 709)

BDL - Below Detection Limit

Data Package ID: GSS0812153-1

Radiochemistry Data Package

Section 5

5

RAW DATA

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab

GammaScan

Geo 1 / Water

Sample ID: 0812153-1 GS081229-1

```

-----
Sampling Start: 12/09/2008 12:00:00 | Counting Start: 12/30/2008 12:44:07
Sampling Stop: 12/09/2008 12:00:00 | Decay Time. . . . . 5.05E+002 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.62E+000 G | Real Time . . . . . 60044 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081979D06.SPC
-----

```

Detector #: 6 (Detector 6)

Energy(keV) = -0.53 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 12/30/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

```

-----
Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000
-----

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=====
PEAK SEARCH RESULTS
=====

```

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.49	94.00	12	58	48	562	0.42 a	NET< CL
2	66.27	133.55	478	104	78	1120	1.01 a	
3	69.44	139.89	29	59	48	560	0.48 b	NET< CL
4	74.71	150.41	67	59	46	530	0.44 a	
5	92.55	186.08	121	78	62	764	0.79 a	
6	139.88	280.73	352	75	53	634	0.68 a	
7	159.39	319.73	55	76	61	753	0.76 a	NET< CL
8	175.26	351.46	114	95	76	995	1.11 a	
9	185.69	372.30	165	88	70	893	1.02 a	
10	198.39	397.70	367	82	60	724	0.84 a	
11	203.32	407.56	56	53	42	427	0.52 a	
12	238.62	478.14	146	71	55	609	0.86 a	
13	326.21	653.25	105	82	65	669	1.30 a	
14	352.09	705.00	93	54	42	396	0.86 a	
15	507.42	1015.56	36	37	29	207	0.66 a	Wide Pk
16	511.04	1022.79	1401	121	78	776	2.48 b	
17	558.45	1117.59	346	59	38	287	1.21 a	
18	569.99	1140.64	30	41	33	241	0.80 a	NET< CL
19	583.33	1167.32	42	50	40	315	1.16 a	
20	596.13	1192.91	192	57	41	332	1.18 a	
21	609.18	1219.02	112	58	45	368	1.35 a	
22	637.91	1276.46	25	50	41	304	1.34 a	NET< CL
23	651.21	1303.04	77	51	39	283	1.32 a	
24	661.66	1323.93	230	58	40	300	1.25 a	

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	718.70	1437.97	29	42	34	224	1.22	a NET< CL
26	803.13	1606.78	53	34	25	157	0.89	a
27	867.94	1736.36	43	37	28	171	1.21	a
28	911.66	1823.76	44	41	32	196	1.46	a
29	1063.86	2128.07	33	38	30	171	1.44	a
30	1461.06	2922.20	420	52	26	119	2.25	a
31	1764.50	3528.89	32	23	17	63	1.31	a

 SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Background File: DET061226.BKG (081226-6 WEEKLY BKG)

Bkg.File Detector #: 6

=====

BACKGROUND SUBTRACT RESULTS

=====

PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
2	66.27	478	104	78	370	176	142	
3	69.44	29	59	48	24	127	104	NET<CL
4	74.71	67	59	46	2	125	103	NET<CL
5	92.55	121	78	62	-21	147	121	NET<CL
6	139.88	352	75	53	264	126	100	
8	175.26	114	95	76	88	197	161	NET<CL
9	185.69	165	88	70	-3	194	160	NET<CL
10	198.39	367	82	60	157	163	133	
11	203.32	56	53	42	10	193	159	NET<CL
12	238.62	146	71	55	60	148	121	NET<CL
14	352.09	93	54	42	-63	142	118	NET<CL
16	511.04	1401	121	78	76	262	215	NET<CL
17	558.45	346	59	38	162	130	105	
18	569.99	30	41	33	-65	102	85	NET<CL
19	583.33	42	50	40	-47	121	100	NET<CL
20	596.13	192	57	41	99	196	160	NET<CL
21	609.18	112	58	45	19	134	110	NET<CL
26	803.13	53	34	25	-75	100	83	NET<CL
28	911.66	44	41	32	-18	98	81	NET<CL
30	1461.06	420	52	26	57	108	88	NET<CL
31	1764.50	32	23	17	-16	62	52	NET<CL

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0812153-1 GS081229-1

```

-----
Sampling Start: 12/09/2008 12:00:00 | Counting Start: 12/30/2008 12:44:07
Sampling Stop: 12/09/2008 12:00:00 | Decay Time. . . . . 5.05e+002 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.62e+000 G | Real Time . . . . . 60044 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081979D06.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
-----
  
```

Detector #: 6 (Detector 6)

Efficiency File: (D06)(Sh01).EFF (Geo 1 Eff Cal)

Eff.=10⁻³[-3.99E+00 +3.72E+00*L +-1.60E+00*L ^2 +1.86E-01*L^3] Above 180.00 keV

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))

MEASURED or MDA CONCENTRATIONS

```

=====
              N
      ENERGY E   Concentration      Critical  Halflife
Nuclide  (keV) T (pCi/G)              Level    (hrs)
-----
Pb-212   238.63 N 1.90E+00 +- 4.68E+00  7.75E+00  3.83E+00  1.67E+04
Bi-214   609.32 N 1.17E+00 +- 8.32E+00  1.38E+01  6.83E+00  1.40E+07
  
```

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY E (keV)	N		Concentration (pCi/G)	MDA	Critical Level	Halflife (hrs)
		T					
Nb-95	765.82	N-5.11E-01	+-	1.88E+00	3.26E+00	1.57E+00	1.54E+03
Co-58	810.75	N-1.91E+00	+-	2.04E+00	3.62E+00	1.75E+00	1.70E+03
Mn-54	834.81	N-7.11E-01	+-	1.83E+00	3.16E+00	1.53E+00	7.49E+03
Sc-46	889.26	N-6.64E-01	+-	1.97E+00	3.42E+00	1.64E+00	2.01E+03
Ac-228	911.07	N 9.82E+00	+-	6.84E+00	1.09E+01	5.24E+00	5.04E+04
Pa-234m	1001.03	N-1.78E+02	+-	3.11E+02	5.45E+02	2.62E+02	3.92E+13
Eu-154	1004.80	N-7.64E-01	+-	9.75E+00	1.68E+01	8.05E+00	7.45E+04
Fe-59	1099.22	N 3.29E+00	+-	4.66E+00	7.70E+00	3.69E+00	1.08E+03
Zn-65	1115.52	N-2.97E+00	+-	4.02E+00	7.13E+00	3.43E+00	5.85E+03
Co-56	1238.28	N 5.95E+00	+-	3.39E+00	5.26E+00	2.50E+00	1.86E+03
Na-22	1274.54	N 1.10E-01	+-	2.00E+00	3.43E+00	1.64E+00	2.28E+04
Co-60	1332.51	N-1.13E+00	+-	1.98E+00	3.52E+00	1.68E+00	4.62E+04
Eu-152	1408.08	N-2.92E+00	+-	9.23E+00	1.62E+01	7.73E+00	1.17E+05
Al-26	1808.65	N-5.39E-01	+-	2.09E+00	3.70E+00	1.75E+00	6.31E+09

MEASURED TOTAL: 1.42E+02 +- 2.13E+02 pCi/G

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.49	94.00	12	58	48	562	0.42	Deleted
2	66.27	133.55	370	176	142	1120	1.01	Unknown
3	69.44	139.89	24	127	104	560	0.48	Deleted
4	74.71	150.41	2	125	103	530	0.44	Deleted
5	92.55	186.08	-21	147	121	764	0.79	Deleted
6	139.88	280.73	264	126	100	634	0.68	Unknown
7	159.39	319.73	55	76	61	753	0.76	Deleted
8	175.26	351.46	88	197	161	995	1.11	Deleted
9	185.69	372.30	-3	194	160	893	1.02	Deleted
10	198.39	397.70	157	163	133	724	0.84	Unknown
11	203.32	407.56	10	193	159	427	0.52	Deleted
13	326.21	653.25	105	82	65	669	1.30	Unknown
14	352.09	705.00	-63	142	118	396	0.86	Deleted
15	507.42	1015.56	36	37	29	207	0.66	Unknown
16	511.04	1022.79	76	262	215	776	2.48	Deleted
17	558.45	1117.59	162	130	105	287	1.21	Unknown
18	569.99	1140.64	-65	102	85	241	0.80	Deleted
19	583.33	1167.32	-47	121	100	315	1.16	Deleted
20	596.13	1192.91	99	196	160	332	1.18	Deleted
22	637.91	1276.46	25	50	41	304	1.34	Deleted
23	651.21	1303.04	77	51	39	283	1.32	Unknown
25	718.70	1437.97	29	42	34	224	1.22	Deleted
26	803.13	1606.78	-75	100	83	157	0.89	Deleted
27	867.94	1736.36	43	37	28	171	1.21	Unknown
28	911.66	1823.76	-18	98	81	196	1.46	Deleted
29	1063.86	2128.07	33	38	30	171	1.44	Unknown

081979D06.SPC Analyzed by

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UNKNOWN, SUM or ESCAPE PEAKS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
31	1764.50	3528.89	-16	62	52	63	1.31	Deleted

c:\SEEKER\BIN\081979d06.res Analysis Results Saved.

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab

GammaScan

Geo 1 / Water

Sample ID: 0812153-1D GS081229-1

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Sampling Start:   12/09/2008 12:00:00 | Counting Start:   12/31/2008 09:46:36
Sampling Stop:    12/09/2008 12:00:00 | Decay Time. . . . . 5.26E+002 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.62E+000 G | Real Time . . . . . 60020 Sec
Collection Efficiency . . . . 1.0000 | Spc. File . . . . . 081791D07.SPC
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Detector #: 7 (Detector 7)

Energy(keV) = -1.42 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 12/31/2008

FWHM(keV) = 0.86 + -0.003*En + 1.34E-03*En^2 + 0.00E+00*En^3 06/30/2008

Where En = Sqrt(Energy in keV)

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Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000
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PEAK SEARCH RESULTS
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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	53.30	109.29	169	104	83	1173	1.18	a
2	63.16	128.98	209	87	68	922	0.85	a
3	66.22	135.09	613	117	87	1290	1.19	b
4	74.74	152.11	131	84	66	886	0.87	a
5	76.97	156.56	169	85	66	886	0.88	b
6	84.08	170.76	108	91	73	987	1.05	a
7	86.89	176.37	58	101	82	1152	1.09	b NET< CL
8	92.53	187.65	537	101	73	995	1.03	a
9	128.99	260.45	59	68	54	655	0.57	a
10	139.72	281.89	473	88	63	788	0.84	a
11	174.92	352.19	122	77	61	749	0.84	a
12	185.72	373.78	328	91	69	882	0.97	a
13	198.43	399.14	559	95	68	850	0.96	a
14	209.49	421.25	39	51	40	402	0.55	a NET< CL
15	238.58	479.35	298	95	73	915	1.12	a
16	248.77	499.70	20	82	67	775	1.08	a NET< CL
17	251.87	505.88	8	55	45	443	0.58	b NET< CL
18	253.39	508.92	58	74	60	664	1.04	c NET< CL
19	295.27	592.57	120	104	84	1089	1.84	a
20	338.37	678.66	84	69	55	598	1.12	a
21	352.07	706.02	202	73	55	604	1.22	a
22	463.49	928.55	35	37	29	202	0.71	a
23	500.36	1002.20	85	75	60	562	1.82	a
24	511.19	1023.83	1739	133	85	852	2.85	a Wide Pk

PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	558.70	1118.71	399	66	43	380	1.32	a
26	569.90	1141.08	51	45	36	292	0.96	a
27	576.12	1153.50	38	54	44	390	1.27	b NET< CL
28	583.51	1168.27	137	63	48	423	1.60	a
29	596.18	1193.58	310	73	52	481	1.82	a
30	609.41	1219.99	266	77	58	582	1.72	a
31	617.55	1236.25	66	58	45	401	1.41	a
32	651.67	1304.39	64	38	28	195	0.83	a
33	662.02	1325.08	257	66	47	414	1.68	a
34	707.86	1416.64	48	48	38	311	1.16	a
35	803.33	1607.32	119	55	42	324	1.93	a
36	868.55	1737.57	51	37	28	183	1.18	a
37	911.07	1822.51	88	43	31	209	1.53	a
38	1120.41	2240.61	55	42	32	203	1.85	a
39	1460.55	2919.97	292	53	33	177	2.60	a
40	1763.38	3524.81	50	34	26	118	2.11	a

 SEEKER B A C K G R O U N D S U B T R A C T R E S U L T S Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab

GammaScan

Background File: DET071226.BKG (081226-7 WEEKLY BKG)

Bkg.File Detector #: 7

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
2	63.16	209	87	68	77	146	119	NET<CL
3	66.22	613	117	87	418	185	148	
4	74.74	131	84	66	28	176	145	NET<CL
5	76.97	169	85	66	32	178	146	NET<CL
6	84.08	108	91	73	13	170	140	NET<CL
7	86.89	58	101	82	-21	175	144	NET<CL
8	92.53	537	101	73	24	220	181	NET<CL
10	139.72	473	88	63	311	195	158	
12	185.72	328	91	69	8	188	155	NET<CL
13	198.43	559	95	68	407	168	134	
15	238.58	298	95	73	62	157	128	NET<CL
19	295.27	120	104	84	-24	173	142	NET<CL
20	338.37	84	69	55	15	124	102	NET<CL
21	352.07	202	73	55	-21	151	124	NET<CL
24	511.19	1739	133	85	43	288	237	NET<CL
25	558.70	399	66	43	207	129	104	
26	569.90	51	45	36	-49	116	96	NET<CL
28	583.51	137	63	48	-14	129	106	NET<CL
29	596.18	310	73	52	233	171	138	
30	609.41	266	77	58	106	148	121	NET<CL
35	803.33	119	55	42	-42	138	114	NET<CL
37	911.07	88	43	31	29	79	65	NET<CL
39	1460.55	292	53	33	139	96	77	

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0812153-1D GS081229-1

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Sampling Start: 12/09/2008 12:00:00 | Counting Start: 12/31/2008 09:46:36
Sampling Stop: 12/09/2008 12:00:00 | Decay Time. . . . . 5.26e+002 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.62e+000 G | Real Time . . . . . 60020 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081791D07.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 7 (Detector 7)

Efficiency File: (D07) (Sh01).EFF (Geo 1 Eff CaL)

Eff.=1/[2.82E-03*En^-3.81E+00 + 1.38E+02*En^8.21E-01] 07/01/2008

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/G)	MDA	Critical Level	Halflife (hrs)
Th-234	92.50	N	5.20E+00 +- 4.84E+01	8.01E+01	3.98E+01	3.92E+13
Sb-125	Average:x		4.81E+00 +- 3.40E+00	. . . . .	. . . . .	2.43E+04
	176.29		1.78E+01 +- 1.13E+01	1.82E+01	8.88E+00	2.43E+04
	427.95	N	2.39E+00 +- 4.10E+00	6.79E+00	3.31E+00	2.43E+04
	463.51		6.99E+00 +- 7.24E+00	1.18E+01	5.64E+00	2.43E+04
Pb-212	238.63	N	1.77E+00 +- 4.44E+00	7.35E+00	3.64E+00	1.67E+04
Pb-214	351.99	N	9.04E-01 +- 6.61E+00	1.10E+01	5.45E+00	1.40E+07
Tl-208	583.14	N	4.04E-01 +- 3.83E+00	6.39E+00	3.16E+00	1.67E+04
Bi-214	Average:x		8.98E+00 +- 6.72E+00	. . . . .	. . . . .	1.40E+07
	609.32	N	5.84E+00 +- 8.20E+00	1.35E+01	6.68E+00	1.40E+07
	1120.28		1.54E+01 +- 1.17E+01	1.88E+01	9.02E+00	1.40E+07
Cs-137	661.62		8.25E+00 +- 2.11E+00	3.12E+00	1.52E+00	2.64E+05
Ag-110M	Average:x		3.92E-01 +- 2.45E+00	. . . . .	. . . . .	6.00E+03
	706.67		9.00E+00 +- 8.93E+00	1.46E+01	7.03E+00	6.00E+03
	657.75	N	3.10E-01 +- 2.55E+00	4.30E+00R	2.11E+00	6.00E+03
Ac-228	911.07	N	3.97E+00 +- 1.10E+01	1.83E+01	8.95E+00	5.04E+04
K-40	1460.75		6.60E+01 +- 4.56E+01	7.40E+01	3.63E+01	1.12E+13
Am-241	59.54	N	7.67E+00 +- 1.02E+01	1.67E+01B	8.22E+00	3.80E+06
Eu-155	105.31	N	7.24E-01 +- 4.14E+00	6.97E+00	3.42E+00	4.35E+04
Co-57	122.07	N	1.13E-01 +- 9.94E-01	1.66E+00	8.15E-01	6.48E+03
Ce-144	133.53	N	4.45E+00 +- 7.37E+00	1.22E+01	5.98E+00	6.82E+03
U-235	143.76	N	9.07E-01 +- 1.32E+01	2.19E+01	1.08E+01	6.17E+12
Ce-139	165.85	N	3.57E-01 +- 1.13E+00	1.88E+00	9.22E-01	3.30E+03
Th-227	236.00	N	2.19E+00 +- 1.31E+01	2.20E+01R	1.09E+01	1.90E+05
Cr-51	320.07	N	3.95E+00 +- 2.05E+01	3.42E+01	1.68E+01	6.65E+02

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY (keV)	N		Concentration (pCi/G)	MDA	Critical Level	Halflife (hrs)
		T					
I-131	364.48	N-2.23E+00	+-	9.69E+00	1.64E+01	8.03E+00	1.93E+02
Be-7	477.56	N 8.87E+00	+-	1.72E+01	2.86E+01	1.39E+01	1.28E+03
Sb-124	602.71	N 5.35E+00	+-	2.15E+00	3.34E+00A	1.63E+00	1.44E+03
Cs-134	604.66	N-3.97E-01	+-	2.58E+00	4.34E+00R	2.14E+00	1.81E+04
Ru-106	621.84	N-5.51E-01	+-	2.20E+01	3.70E+01r	1.81E+01	8.84E+03
Nb-94	702.50	N-1.81E-01	+-	1.93E+00	3.26E+00B	1.59E+00	1.78E+08
Bi-212	727.17	N 1.47E+01	+-	2.62E+01	4.34E+01	2.11E+01	1.67E+04
Nb-95	765.82	N 1.26E+00	+-	2.07E+00	3.43E+00	1.66E+00	1.54E+03
Co-58	810.75	N 6.88E-01	+-	1.92E+00	3.22E+00b	1.55E+00	1.70E+03
Mn-54	834.81	N-2.29E+00	+-	1.89E+00	3.34E+00	1.62E+00	7.49E+03
Sc-46	889.26	N-1.50E+00	+-	2.00E+00	3.50E+00	1.70E+00	2.01E+03
Pa-234m	1001.03	N 1.06E+02	+-	3.12E+02	5.24E+02	2.53E+02	3.92E+13
Eu-154	1004.80	N-4.97E+00	+-	1.05E+01	1.83E+01	8.84E+00	7.45E+04
Fe-59	1099.22	N 1.55E+00	+-	5.01E+00	8.42E+00	4.07E+00	1.08E+03
Zn-65	1115.52	N-2.06E-01	+-	5.84E+00	9.87E+00R	4.82E+00	5.85E+03
Co-56	1238.28	N 1.32E+00	+-	3.85E+00	6.46E+00	3.12E+00	1.86E+03
Na-22	1274.54	N 1.90E-01	+-	2.10E+00	3.57E+00	1.72E+00	2.28E+04
Co-60	1332.51	N-9.04E-01	+-	2.12E+00	3.69E+00	1.78E+00	4.62E+04
Eu-152	1408.08	N 7.11E+00	+-	9.57E+00	1.58E+01	7.57E+00	1.17E+05
Al-26	1808.65	N 1.04E+00	+-	2.42E+00	4.07E+00	1.95E+00	6.31E+09

MEASURED TOTAL: 2.64E+02 +- 5.62E+02 pCi/G

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	53.30	109.29	169	104	83	1173	1.18	Unknown
2	63.16	128.98	77	146	119	922	0.85	Deleted
3	66.22	135.09	418	185	148	1290	1.19	Unknown
4	74.74	152.11	28	176	145	886	0.87	Deleted
5	76.97	156.56	32	178	146	886	0.88	Deleted
6	84.08	170.76	13	170	140	987	1.05	Deleted
7	86.89	176.37	-21	175	144	1152	1.09	Deleted
9	128.99	260.45	59	68	54	655	0.57	Unknown
10	139.72	281.89	311	195	158	788	0.84	Unknown
12	185.72	373.78	8	188	155	882	0.97	Deleted
13	198.43	399.14	407	168	134	850	0.96	Unknown
14	209.49	421.25	39	51	40	402	0.55	Deleted
16	248.77	499.70	20	82	67	775	1.08	Deleted
17	251.87	505.88	8	55	45	443	0.58	Deleted
18	253.39	508.92	58	74	60	664	1.04	Deleted
19	295.27	592.57	-24	173	142	1089	1.84	Deleted
20	338.37	678.66	15	124	102	598	1.12	Deleted
23	500.36	1002.20	85	75	60	562	1.82	Unknown
24	511.19	1023.83	43	288	237	852	2.85	Deleted
25	558.70	1118.71	207	129	104	380	1.32	Unknown

081791D07.SPC Analyzed by

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
26	569.90	1141.08	-49	116	96	292	0.96	Deleted
27	576.12	1153.50	38	54	44	390	1.27	Deleted
29	596.18	1193.58	233	171	138	481	1.82	Unknown
31	617.55	1236.25	66	58	45	401	1.41	Unknown
32	651.67	1304.39	64	38	28	195	0.83	Unknown
35	803.33	1607.32	-42	138	114	324	1.93	Deleted
36	868.55	1737.57	51	37	28	183	1.18	Unknown
40	1763.38	3524.81	50	34	26	118	2.11	Unknown

c:\SEEKER\BIN\081791d07.res Analysis Results Saved.

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab

GammaScan

Geo 1 / Water

Sample ID: GS081229-1MB GS081229-1

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Sampling Start:   12/30/2008 12:00:00 | Counting Start:   12/30/2008 12:44:11
Sampling Stop:    12/30/2008 12:00:00 | Decay Time. . . . . 7.36E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.62E+000 G | Real Time . . . . . 60019 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081787D07.SPC
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Detector #: 7 (Detector 7)

Energy(keV) = -1.43 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 12/30/2008

FWHM(keV) = 0.86 + -0.003*En + 1.34E-03*En^2 + 0.00E+00*En^3 06/30/2008

Where En = Sqrt(Energy in keV)

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Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000
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PEAK SEARCH RESULTS
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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.27	95.29	105	99	80	1078	1.10	a
2	53.40	109.52	153	120	96	1374	1.46	a
3	63.10	128.90	268	96	74	1024	0.92	a HiResid
4	66.16	135.02	679	114	84	1195	1.10	b HiResid
5	74.85	152.38	59	58	46	521	0.47	a
6	76.96	156.59	69	58	46	521	0.48	b
7	84.63	171.91	60	77	62	779	0.87	a NET< CL
8	87.07	176.79	35	87	71	935	0.91	b NET< CL
9	92.48	187.58	550	106	78	1048	1.13	a
10	104.43	211.46	62	52	41	414	0.50	a
11	139.76	282.03	389	83	60	731	0.81	a
12	143.77	290.04	84	65	51	585	0.72	b
13	175.04	352.51	114	93	75	952	1.16	a
14	185.77	373.95	332	97	74	922	1.07	a
15	198.41	399.19	515	97	71	848	1.19	a
16	209.19	420.73	48	71	57	663	0.80	a NET< CL
17	238.67	479.61	247	82	62	714	0.95	a
18	338.80	679.64	71	70	56	578	1.34	a
19	352.14	706.27	131	61	46	455	0.91	a
20	511.25	1024.10	1602	132	87	888	2.86	a Wide Pk
21	538.18	1077.91	44	43	34	261	0.91	a
22	558.78	1119.07	427	67	44	370	1.49	a
23	583.58	1168.60	89	49	38	306	1.19	a
24	596.66	1194.74	189	72	55	534	1.75	a

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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
25	609.59	1220.56	107	49	37	308	1.04	a
26	651.89	1305.06	48	40	31	216	1.03	a
27	803.52	1607.94	66	36	27	177	0.93	a
28	898.10	1796.88	53	53	42	306	2.32	a
29	911.39	1823.41	95	45	34	218	1.74	a
30	1460.87	2921.06	285	58	39	200	3.37	a

SEEKER BACKGROUND SUBTRACT RESULTS Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET071226.BKG (081226-7 WEEKLY BKG)

Bkg.File Detector #: 7

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
3	63.10	268	96	74	136	152	123	
4	66.16	679	114	84	484	183	146	
5	74.85	59	58	46	-44	165	136	NET<CL
6	76.96	69	58	46	-68	167	138	NET<CL
7	84.63	60	77	62	-35	163	134	NET<CL
8	87.07	35	87	71	-44	167	138	NET<CL
9	92.48	550	106	78	36	222	183	NET<CL
11	139.76	389	83	60	227	193	157	
12	143.77	84	65	51	32	148	121	NET<CL
14	185.77	332	97	74	12	191	157	NET<CL
15	198.41	515	97	71	363	169	136	
17	238.67	247	82	62	12	149	122	NET<CL
18	338.80	71	70	56	1	124	102	NET<CL
19	352.14	131	61	46	-92	145	120	NET<CL
20	511.25	1602	132	87	-94	288	238	NET<CL
21	538.18	44	43	34	16	100	82	NET<CL
22	558.78	427	67	44	235	130	104	
23	583.58	89	49	38	-61	123	102	NET<CL
24	596.16	100	50	55	111	171	140	NET<CL

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: GS081229-1MB GS081229-1

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Sampling Start:   12/30/2008 12:00:00 | Counting Start:   12/30/2008 12:44:11
Sampling Stop:    12/30/2008 12:00:00 | Decay Time. . . . . 7.36e-001 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.62e+000 G | Real Time . . . . . 60019 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081787D07.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 7 (Detector 7)

Efficiency File: (D07) (Sh01).EFF (Geo 1 Eff CaL)

Eff.=1/[2.82E-03*En^-3.81E+00 + 1.38E+02*En^8.21E-01] 07/01/2008

Library File: FANP.LIB (FANP (Fiss. Act. and Nat. Products))

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/G)	MDA	Critical Level	Halflife (hrs)
Th-234	Average:x	2.16E+01	+ - 4.57E+01	. . . . .	. . . . .	3.92E+13
	63.29	1.13E+02	+ - 1.27E+02	2.09E+02	1.03E+02	3.92E+13
	92.50 N	7.94E+00	+ - 4.90E+01	8.10E+01	4.02E+01	3.92E+13
Eu-155	105.31	2.95E+00	+ - 2.50E+00	4.05E+00	1.96E+00	4.35E+04
Sb-125	Average:x	2.32E+00	+ - 3.62E+00	. . . . .	. . . . .	2.43E+04
	176.29	1.64E+01	+ - 1.34E+01	2.18E+01	1.07E+01	2.43E+04
	427.95 N	1.21E+00	+ - 3.76E+00	6.28E+00	3.06E+00	2.43E+04
Pb-212	238.63 N	3.24E-01	+ - 4.13E+00	6.86E+00	3.39E+00	1.67E+04
Pb-214	351.99 N	4.04E+00	+ - 6.37E+00	1.07E+01	5.28E+00	1.40E+07
Ac-228	911.07 N	4.86E+00	+ - 1.11E+01	1.84E+01	9.03E+00	5.04E+04
K-40	1460.75	6.23E+01	+ - 4.68E+01	7.62E+01	3.75E+01	1.12E+13
Am-241	59.54 N	7.11E+00	+ - 9.67E+00	1.59E+01B	7.82E+00	3.80E+06
Co-57	122.07 N	1.71E-01	+ - 8.93E-01	1.49E+00	7.31E-01	6.48E+03
Ce-144	133.53 N	2.68E+00	+ - 6.75E+00	1.12E+01	5.50E+00	6.82E+03
U-235	143.76 N	1.17E+01	+ - 6.97E+00	1.12E+01b	5.50E+00	6.17E+12
Ce-139	165.85 N	4.49E-01	+ - 9.71E-01	1.65E+00	8.07E-01	3.30E+03
Th-227	236.00 N	4.38E+00	+ - 1.26E+01	2.08E+01R	1.03E+01	1.90E+05
Cr-51	320.07 N	1.52E+00	+ - 1.10E+01	1.87E+01	9.12E+00	6.65E+02
I-131	364.48 N	1.69E-01	+ - 1.47E+00	2.48E+00	1.21E+00	1.93E+02
Be-7	477.56 N	1.72E+00	+ - 1.24E+01	2.10E+01	1.02E+01	1.28E+03
Tl-208	583.14 N	2.68E+00	+ - 1.81E+00	2.92E+00	1.42E+00	1.67E+04
Sb-124	602.71 N	1.65E+00	+ - 1.77E+00	3.05E+00b	1.49E+00	1.44E+03
Cs-134	604.66 N	2.18E+00	+ - 1.75E+00	3.06E+00	1.49E+00	1.81E+04
Bi-214	609.32 N	7.85E+00	+ - 3.69E+00	5.82E+00	2.84E+00	1.40E+07
Ru-106	621.84 N	1.93E+01	+ - 1.55E+01	2.73E+01	1.33E+01	8.84E+03

MEASURED or MDA CONCENTRATIONS

Nuclide	ENERGY E (keV)	N		Concentration (pCi/G)	MDA	Critical Level	Halflife (hrs)
		T					
Ag-110M	657.75	N-3.21E-01	+-	1.54E+00	2.63E+00b	1.28E+00	6.00E+03
Cs-137	661.62	N-9.61E-01	+-	1.69E+00	2.93E+00	1.42E+00	2.64E+05
Nb-94	702.50	N-4.33E-01	+-	1.87E+00	3.18E+00	1.55E+00	1.78E+08
Bi-212	727.17	N 2.20E+01	+-	2.44E+01	4.00E+01	1.94E+01	1.67E+04
Nb-95	765.82	N 1.45E-01	+-	1.56E+00	2.64E+00	1.28E+00	1.54E+03
Co-58	810.75	N-1.52E+00	+-	1.55E+00	2.74E+00	1.33E+00	1.70E+03
Mn-54	834.81	N-2.31E-01	+-	1.76E+00	2.99E+00	1.45E+00	7.49E+03
Sc-46	889.26	N 6.98E-02	+-	1.63E+00	2.78E+00	1.34E+00	2.01E+03
Pa-234m	1001.03	N 2.78E+02	+-	3.01E+02	4.93E+02	2.38E+02	3.92E+13
Eu-154	1004.80	N 3.74E-01	+-	9.76E+00	1.66E+01	8.02E+00	7.45E+04
Fe-59	1099.22	N 2.48E+00	+-	3.32E+00	5.48E+00	2.64E+00	1.08E+03
Zn-65	1115.52	N 2.18E+00	+-	3.89E+00	6.48E+00	3.13E+00	5.85E+03
Co-56	1238.28	N 9.65E-01	+-	2.98E+00	5.01E+00	2.41E+00	1.86E+03
Na-22	1274.54	N-2.10E-01	+-	1.91E+00	3.29E+00	1.58E+00	2.28E+04
Co-60	1332.51	N-5.58E-01	+-	1.96E+00	3.41E+00	1.64E+00	4.62E+04
Eu-152	1408.08	N-1.77E+00	+-	1.06E+01	1.82E+01	8.78E+00	1.17E+05
Al-26	1808.65	N 8.54E-01	+-	2.41E+00	4.07E+00	1.95E+00	6.31E+09

MEASURED TOTAL: 4.38E+02 +- 5.07E+02 pCi/G

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	46.27	95.29	105	99	80	1078	1.10	Unknown
2	53.40	109.52	153	120	96	1374	1.46	Unknown
4	66.16	135.02	484	183	146	1195	1.10	Unknown
5	74.85	152.38	-44	165	136	521	0.47	Deleted
6	76.96	156.59	-68	167	138	521	0.48	Deleted
7	84.63	171.91	-35	163	134	779	0.87	Deleted
8	87.07	176.79	-44	167	138	935	0.91	Deleted
11	139.76	282.03	227	193	157	731	0.81	Unknown
12	143.77	290.04	32	148	121	585	0.72	Deleted
14	185.77	373.95	12	191	157	922	1.07	Deleted
15	198.41	399.19	363	169	136	848	1.19	Unknown
16	209.19	420.73	48	71	57	663	0.80	Deleted
18	338.80	679.64	1	124	102	578	1.34	Deleted
20	511.25	1024.10	-94	288	238	888	2.86	Deleted
21	538.18	1077.91	16	100	82	261	0.91	Deleted
22	558.78	1119.07	235	130	104	370	1.49	Unknown
23	583.58	1168.60	-61	123	102	306	1.19	Deleted
24	596.66	1194.74	111	171	140	534	1.75	Deleted
25	609.59	1220.56	-54	136	112	308	1.04	Deleted
26	651.89	1305.06	48	40	31	216	1.03	Unknown
27	803.52	1607.94	-95	131	109	177	0.93	Deleted
28	898.10	1796.88	-6	98	81	306	2.32	Deleted

081787D07.SPC Analyzed by
c:\SEEKER\BIN\081787d07.res Analysis Results Saved.

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab

GammaScan

Geo 1 / Water

Sample ID: GS081229-1LCS GS081229-1

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Sampling Start:   12/31/2008 09:00:00 | Counting Start:   12/31/2008 09:08:16
Sampling Stop:    12/31/2008 09:00:00 | Decay Time. . . . . 1.38E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 1824 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081790D07.SPC
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Detector #: 7 (Detector 7)

Energy(keV) = -1.42 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 12/31/2008

FWHM(keV) = 0.86 + -0.003*En + 1.34E-03*En^2 + 0.00E+00*En^3 06/30/2008

Where En = Sqrt(Energy in keV)

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Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000
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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	58.32	119.30	1311	309	247	7950	1.85	a Wide Pk
2	59.38	121.42	16718	299	123	3066	0.87	b
3	87.92	178.44	18644	318	133	3287	0.93	a
4	103.11	208.78	64	79	64	1003	0.49	a NET< CL
5	121.98	246.46	5209	193	106	2058	1.00	a
6	136.39	275.25	663	133	101	1887	1.03	a
7	155.34	313.09	75	105	85	1468	0.78	a NET< CL
8	165.96	334.29	679	128	96	1711	0.92	a HiResid
9	391.85	785.46	249	111	88	1416	1.27	a
10	511.81	1025.07	95	101	82	1166	1.48	a
11	530.79	1062.98	48	63	50	620	0.84	a NET< CL
12	581.99	1165.23	28	56	45	510	0.78	a NET< CL
13	661.99	1325.02	23182	321	84	1318	1.68	a HiResid
14	692.03	1385.02	82	78	62	755	1.48	a
15	806.39	1613.42	80	67	53	649	1.13	a
16	898.32	1797.04	213	112	89	1451	1.91	a
17	1173.37	2346.39	19846	298	80	1103	2.27	a HiResid
18	1332.43	2664.07	17530	271	46	353	2.44	a HiResid
19	1835.07	3667.99	116	28	15	33	2.71	a

081790D07.SPC Analyzed by

SEEKER B A C K G R O U N D S U B T R A C T R E S U L T S Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File:. DET071226.BKG (081226-7 WEEKLY BKG)

Bkg.File Detector #: 7

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
3	87.92	18644	318	133	18642	318	133	
10	511.81	95	101	82	44	102	83	NET<CL
12	581.99	28	56	45	23	56	46	NET<CL
16	898.32	213	112	89	211	112	89	

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: GS081229-1LCS GS081229-1

 Sampling Start: 12/31/2008 09:00:00 | Counting Start: 12/31/2008 09:08:16
 Sampling Stop: 12/31/2008 09:00:00 | Decay Time. 1.38e-001 Hrs
 Buildup Time. 0.00e+000 Hrs | Live Time 1800 Sec
 Sample Size 1.00e+000 L | Real Time 1824 Sec
 Collection Efficiency 1.0000 | Spectrum File 081790D07.SPC
 Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %

Detector #: 7 (Detector 7)

Efficiency File: (D07) (Sh01).EFF (Geo 1 Eff CaL)

Eff.=1/[2.82E-03*En^-3.81E+00 + 1.38E+02*En^8.21E-01] 07/01/2008

 Library File:ANALYTICAL.LIB (Analytical)
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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Halflife (hrs)
Am-241	59.54	1.00E+05 +- 1.79E+03	1.50E+03	7.40E+02	3.79E+06	
Cd-109	88.02	3.73E+05 +- 6.35E+03	5.39E+03	2.67E+03	1.11E+04	
Co-57	122.07	3.01E+03 +- 1.12E+02	1.24E+02	6.10E+01	6.50E+03	
Ce-139	165.85	4.33E+02 +- 8.17E+01	1.25E+02	6.14E+01	3.30E+03	
Sn-113	391.68	3.68E+02 +- 1.64E+02	2.63E+02	1.29E+02	2.76E+03	
Cs-137	661.62	4.01E+04 +- 5.56E+02	2.97E+02	1.46E+02	2.64E+05	
Y-88	Average:x	4.03E+02 +- 8.80E+01	. . . .	. . . .	2.56E+03
	898.02	4.27E+02 +- 2.26E+02	3.65E+02	1.80E+02	2.56E+03	
	1836.01	3.99E+02 +- 9.56E+01	1.09E+02	5.01E+01	2.56E+03	
Co-60	Average:x	4.64E+04 +- 4.99E+02	. . . .	. . . .	4.62E+04
	1173.21	4.68E+04 +- 7.04E+02	3.86E+02	1.90E+02	4.62E+04	
	1332.48	4.59E+04 +- 7.09E+02	2.50E+02	1.21E+02	4.62E+04	
Hg-203	279.18	MDA	1.65E+02	8.14E+01	1.12E+03	

MEASURED TOTAL: 5.64E+05 +- 9.65E+03 pCi/L

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UNKNOWN, SUM or ESCAPE PEAKS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	58.32	119.30	1311	309	247	7950	1.85	Unknown
4	103.11	208.78	64	79	64	1003	0.49	Deleted
6	136.39	275.25	663	133	101	1887	1.03	Unknown

081790D07.SPC Analyzed by

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
7	155.34	313.09	75	105	85	1468	0.78	Deleted
10	511.81	1025.07	44	102	83	1166	1.48	Deleted
11	530.79	1062.98	48	63	50	620	0.84	Deleted
12	581.99	1165.23	23	56	46	510	0.78	Deleted
14	692.03	1385.02	82	78	62	755	1.48	Unknown
15	806.39	1613.42	80	67	53	649	1.13	Unknown

c:\SEEKER\BIN\081790d07.res Analysis Results Saved.

Gamma Spectrometer Run Log

Date: 12-30-08

Reviewed By/Date: WV 12-31-08

			Count Dur.	Count Time	Analyst	File ID/Comments	Saved?
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Gamma Spectrometer Run Log

Date: 12-31-08

Reviewed By/Date: WAC 1-2-09

Date	Description	Amount	Balance	Total	Remarks
1972	Jan 1	100.00	100.00	100.00	Opening Balance
1972	Jan 15	50.00	50.00	50.00	Deposit
1972	Feb 1	25.00	25.00	25.00	Deposit
1972	Mar 1	75.00	75.00	75.00	Deposit
1972	Apr 1	125.00	125.00	125.00	Deposit
1972	May 1	175.00	175.00	175.00	Deposit
1972	Jun 1	225.00	225.00	225.00	Deposit
1972	Jul 1	275.00	275.00	275.00	Deposit
1972	Aug 1	325.00	325.00	325.00	Deposit
1972	Sep 1	375.00	375.00	375.00	Deposit
1972	Oct 1	425.00	425.00	425.00	Deposit
1972	Nov 1	475.00	475.00	475.00	Deposit
1972	Dec 1	525.00	525.00	525.00	Deposit
1972	Total	2,500.00	2,500.00	2,500.00	Total



Technical Comments Regarding Analysis using the FANP Gamma Spectroscopy Library

Analysis using the FANP (Fission, Activation, and Natural Products) library is limited to the list of gamma emitting radionuclides specified by Paragon Analytics. Paragon Analytics specifies all values assigned to the nuclides in this library. In cases where multiple gamma emissions are used to quantify activity, the most abundant emission is used for quantification in the absence of any supporting gamma emissions. It should be noted that the current software program used for gamma spectroscopic analysis is limited to a +/- 2.0 keV photo-peak resolution tolerance. Thus, any gamma emissions occurring within the same +/- 2.0 keV range will suffer interference, consequently preventing accurate quantification. Nuclide specific information regarding analysis using the FANP library is as follows:

Nuclide: ^{228}Ac Energy: various Photon Abundance: various

All activity values for ^{228}Ac are calculated using the half-life, $t_{1/2}=5.75$ years, of the long-lived ^{228}Ra parent. It is assumed that secular equilibrium is achieved between the ^{228}Ra parent and the ^{228}Ac progeny.

Nuclide: ^{212}Bi , ^{212}Pb , ^{208}Tl Energy: various Photon Abundance: various

All activity values for ^{212}Bi , ^{212}Pb , and ^{208}Tl are calculated using the half-life, $t_{1/2}=1.91$ years, of the long-lived ^{228}Th parent. It is assumed that secular equilibrium is achieved between the ^{228}Th parent and the ^{212}Bi , ^{212}Pb , ^{208}Tl progeny.

Nuclide: ^{214}Bi , ^{214}Pb Energy: various Photon Abundance: various

All activity values for ^{214}Bi and ^{214}Pb are calculated using the half-life, $t_{1/2}=1600$ years, of the long-lived ^{226}Ra parent. It is assumed that secular equilibrium is achieved between the ^{226}Ra parent and the ^{214}Bi and ^{214}Pb progeny.

Nuclide: ^{60}Co Energy: 1175.13 keV Photon Abundance: 0.0228

This emission for this nuclide suffers from possible resolution interference due to the ^{60}Co gamma emission occurring at 1173.23 keV (0.9997, abundance). Therefore, this emission will be used as an identifier only and not in the activity calculations for this nuclide.

Nuclides: ^{57}Co Energy: 122.07 Photon Abundance: 0.8560

The most abundant gamma emission specified for quantification of this nuclide suffers from possible resolution interference due to the ^{152}Eu gamma emission occurring at 121.78 keV (0.2050, abundance). Therefore, a possibility of a high bias to the ^{57}Co results may occur in the presence of elevated ^{152}Eu activity.



Nuclide: ^{134}Cs

Energy: 604.66

Photon Abundance: 0.9762

Cesium-134 suffers from coincidence summing, due to the multiple simultaneous photon emissions during each decay event. This results in a potentially low bias in the final analytical results. The magnitude of this low bias is highly dependent on the Cs-134 activity levels and the specific counting geometry. Any Cs-134 activity reported above the associated Minimum Detectable Concentration should be considered to have a potential low bias.

The most abundant gamma emission specified for quantification of this nuclide suffers from possible resolution interference due to the ^{124}Sb gamma emission occurring at 602.71 keV (0.9826, abundance). Therefore, a possibility of a high bias to the ^{134}Cs results may occur in the presence of elevated ^{124}Sb activity.

Other gamma emissions used for quantification of this nuclide suffer from possible resolution interference due to multiple gamma emissions of ^{228}Ac . Therefore, a possible high bias to the ^{134}Cs activity results may occur in the presence of elevated ^{228}Ac activity.

Nuclide: ^{137}Cs

Energy: 661.62 keV

Photon Abundance: 0.8512

Cesium-137 does not emit any gamma photons useful for quantification. However, it can be assumed to be in secular equilibrium with the short-lived $^{137\text{m}}\text{Ba}$ daughter product. Therefore, the activity for ^{137}Cs is determined from the 661.62 keV gamma emission of the $^{137\text{m}}\text{Ba}$.

daughter product. The calculated gamma photon abundance used in the library is the product of the 0.8998 abundance of the 661.62 keV $^{137\text{m}}\text{Ba}$ photon and the 0.946 branching ratio between ^{137}Ba and $^{137\text{m}}\text{Ba}$.

Nuclide: ^{155}Eu

Energy: 105.31

Photon Abundance: 0.2120

The only gamma emission useful for quantification of this nuclide suffers from possible resolution interference due to the ^{235}U gamma emission occurring at 105 keV (0.0210, abundance). Therefore, a possibility of a high bias to the ^{155}Eu results may occur in the presence of elevated ^{235}U .



Nuclide: ^{95}Nb Energy: 765.82 Photon Abundance: 0.9999

All activity values for ^{95}Nb are calculated using the half-life, $t_{1/2}=64.02$ days, of the ^{95}Zr parent. It is assumed that a transient equilibrium is achieved between the ^{95}Zr parent and the ^{95}Nb progeny.

The only gamma emission useful for quantification of this nuclide suffers from possible resolution interference due to the $^{234\text{m}}\text{Pa}$ gamma emission occurring at 766.6 keV (0.0020, abundance). Therefore, a possibility of a high bias to the ^{95}Nb results may occur in the presence of elevated $^{234\text{m}}\text{Pa}$ activity.

Nuclide: $^{234\text{m}}\text{Pa}$ Energy: 1001.03 Photon Abundance: 0.0059

All activity values for $^{234\text{m}}\text{Pa}$ are calculated using the half-life, $t_{1/2}=4.468\text{E}+09$ yrs, of the long-lived ^{238}U parent. It is assumed that secular equilibrium is achieved between the ^{238}U parent and the $^{234\text{m}}\text{Pa}$ progeny.

Nuclide: ^{106}Ru Energy: various Photon Abundance: various

Ru-106 does not emit any gamma photons. Therefore, all activity values for ^{106}Ru are calculated using the gamma emissions of the short-lived ^{106}Rh daughter. The half-life, $t_{1/2}=368.2$ days, of the ^{106}Ru parent is used in the activity calculations. It is assumed that a secular equilibrium is achieved between the ^{106}Ru parent and the ^{106}Rh progeny.

Nuclide: ^{124}Sb Energy: 602.71 Photon Abundance: 0.9826

The most abundant gamma emission specified for quantification of this nuclide suffers from possible resolution interference due to the ^{134}Cs gamma emission occurring at 604.66 keV (0.9762, abundance). Therefore, a possibility of a high bias to the ^{124}Sb results may occur in the presence of elevated ^{134}Cs activity.

Nuclide: ^{125}Sb Energy: 600.77 Photon Abundance: 0.1786

The gamma emission specified for quantification of this nuclide that occurs at 600.77 keV suffers from possible resolution interference due to the ^{124}Sb gamma emission occurring at 602.71 keV (0.9826, abundance). Therefore, this photo-peak will be used as an identifier only and not in the activity calculations for this nuclide.

Nuclide: ^{227}Th Energy: 236.00 Photon Abundance: 0.1230

All activity values for ^{227}Th are calculated using the half-life, $t_{1/2}=21.7$ yrs, of the long-lived ^{227}Ac parent. It is assumed that secular equilibrium is achieved between the ^{227}Ac parent and the ^{227}Th progeny.



Nuclide: ^{234}Th

Energy: 92.50

Photon Abundance: 0.0553

The 92.50 keV photo-peak used in this library for Th-234 quantification is actually two separate photo-peaks, occurring at 92.4 keV and 92.8 keV. The current software used for gamma spectroscopic analysis cannot resolve two photo-peaks that occur within the 2-keV resolution tolerance. Therefore, these two photopeaks are observed as a single photo-peak. Therefore, the average of the two photo-peak energies is used in this library. Also, the sum of the two photo-peak abundances, 0.0553, is used in the activity calculations for this observed 'single' photo-peak.

All activity values for ^{234}Th are calculated using the half-life, $t_{1/2}=4.468\text{E}+09$ yrs, of the long-lived ^{238}U parent. It is assumed that secular equilibrium is achieved between the ^{238}U parent and the ^{234}Th progeny.

Nuclide: ^{235}U

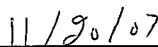
Energy: 185.70

Photon Abundance: 0.5720

Quantifying ^{235}U activity using the 185.70 keV photo-peak is vulnerable to a significant high bias due to interference from gamma emissions from ^{226}Ra occurring at 186.21 keV (0.0328, abundance). Therefore, this emission will be used as an identifier only and not in the activity calculations for this nuclide.

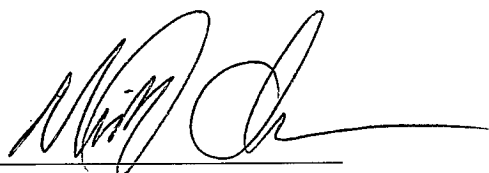


Gamma Spectroscopist

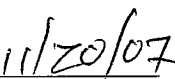


Date

Radiochemistry Instrumentation Laboratory



Radiochemistry Manager



Date

Library File: FANP.lib

File I.D.: FANP (Fiss. Act. and Nat. Products)

Pk. #	Energy (keV)	Isotope Name	2ndary Pk #	Type	Gamma Fraction	Halflife
24	338.40	Ac-228	61	QUANT	0.1127	5.7500E+00 yrs
61	911.07	Ac-228	63	NET	0.2580	5.7500E+00 yrs
63	968.90	Ac-228	24	QUANT	0.1580	5.7500E+00 vrs

Pk. #	Energy (keV)	Isotope Name	2ndary Pk #	Type	Gamma Fraction	Halflife
14	192.34	Fe-59	70	QUANT	0.0308	4.5100E+01 dys
70	1099.22	Fe-59	79	NET	0.5650	4.5100E+01 dys
79	1291.56	Fe-59	14	QUANT	0.4320	4.5100E+01 dys
20	284.29	I-131	27	QUANT	0.0614	8.0405E+00 dys
27	364.48	I-131	20	NET	0.8170	8.0405E+00 dys
86	1460.75	K-40	0	NET	0.1100	1.2800E+09 yrs
55	834.81	Mn-54	0	NET	0.9997	3.1220E+02 dys

Radiochemistry Data Package

Section 6

QUALITY ASSURANCE SUMMARY REPORTS

6

QUALITY ASSURANCE SUMMARY SHEET

PAR W.O. # / BATCH 0812153
TEST 8
METHOD Prep
SOP/REV (PREP) 739/9
SOP/REV (ANAL) _____

Briefly document any QA or other problems or deviations associated with the analysis of samples. Problems could result from: log-in, color, odor, dilution, consistency, scheduling, equipment, or instrumentation, or may include documentation of minor deviations necessary due to unique DQO's or sample characteristics.

- 1E 12/30/08
1. Sample 0812153-1 consisted of a small rock that was placed into a Ziploc bag and crushed with a rubber mallet. The crushed rock was then transferred to a 220mL polypropylene cup and weighed.
 - 7E 12/30/08 2. A three acid digestion was performed by adding 25mL each of HNO₃, HCl, and HF to the sample cup. A MB, LCS, and LCSD were created at this time by adding all three acids to empty 220mL cups.
 3. Following digestion, the sample was taken to dryness and then brought up in 10ml HNO₃ and ~150ml DI water. 1E 12/30/08
 4. The sample was filtered through qualitative fluted filter paper, diluted to 1000ml with DI water, and packed for a geometry 1 gamma analysis.
 5. Following gamma analysis, the sample will be released for all remaining rad analyses.

TECHNICIAN/ANALYST

1 Elbert

DATE

12/30/08

DEPARTMENT MANAGER

Cristen Shaffer

DATE

12/30/08

Radiochemistry Data Package

Section 7

LABORATORY BENCH SHEETS



Instrument Worksheet

Prep Batch: GS081229-1

Analytical QASS / NCR? Y / N NA

Cnt 2 Inst/Det	Cnt 2 Count Date	Cnt 3 File Cnt Dur (min)	Cnt 3 Inst/Det	Cnt 3 Count Date	Notes

NA 1-6-09

Count dup.

NA 1-6-09

Spike Solution Information

Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
Am-241	824	220.230	DPM/ml	12/29/08	1000	ml	
Co-60	824	102.627	DPM/ml	12/29/08	1000	ml	
Cs-137	824	83.585	DPM/ml	12/29/08	1000	ml	



ragon

mt 6.221A

Supersedes:

NA

Radiochemistry Prep Worksheet

ALS Paragon

Prep Batch: GS081229-1

Prep Procedure: GAMMASCAN

Reviewed By: tde 100 Review Date: 12/30/2008

Non-Routine Pre-Treatment? (Y) N Batch: See QASS Re-Prep? Y / (N) Batch: NA Prep QASS / NCR? (Y) / N 365782

Prep SOP: PAI 739 Rev: 9
Prep SOP: NONE
Matrix Class: solid
Prep Analyst: Tambræ Elhart
Prep Date: 12/29/2008
Prep Dept: GM

Balance:
Balance:

Sample Num	Prep Num	LabID	QC Type	Dish No.	Init Aliq g	Fin Aliq g	Prep Basis	Geometry	Standards	Prep Notes
1	1	0812153-1	SNP		1.6212	1.6212	As Received	01		<u>12/29/08</u>
2	1	0812153-1	DUP		1.6212	1.6212	As Received	01		<u>12/29/08</u>
3	1	GS081229-1	MB		1.6212	1.6212	As Received	01		<u>12/29/08</u>
4	1	GS081229-1	LCS		1000	1000	As Received	01	S1	<u>12/29/08</u>

Comments

Spiked By: N/A Date: N/A

Witnessed By: N/A Date: N/A

Spike Solution Information						
Soln #	Nuclide	SolnID	Prep Conc	Units	Prep Date	Pipet ID
S1	Am-241	824	220.230	DPM/ml	12/29/08	1000 ml
S1	Co-60	824	102.627	DPM/ml	12/29/08	1000 ml
S1	Cs-137	824	83.585	DPM/ml	12/29/08	1000 ml

Prep Worksheet

Prep Batch: GS081229-1

Not Validated!!!

Reviewed By:

Review Date:

Batch:

Prep QASS / NCR? Y / N

Balance:

Balance:

Prep Notes

1.6212g

Count Dup, Insuff Sample

Spike Solution Information

Nuclide	SolnID	Prep Conc	Units	Prep Date	Aliquot	Units	Pipet ID
Am-241	824	220.230	DPM/ml	12/29/08	1000	ml	
Co-60	824	102.627	DPM/ml	12/29/08	1000	ml	
Cs-137	824	83.585	DPM/ml	12/29/08	1000	ml	

Paragon

Version: 6.220A

Supersedes:

NA

ANALYST:

78

ANALYSIS DATE:

12/29/08

METHOD: Prep

18/12/2018

Radiochemistry Data Package

Section 8

STANDARDS TRACEABILITY DOCUMENTS



An Isotope Products Laboratories Company

Fax 404-352-2837
www.analytixinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
JUS

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776.
Density of solid matrix 1.15 g/cc.

Calibration date: July 1, 2006 12:00 EST

TOTAL

Radiochemistry Data Package

Section 9

ADDITIONAL SUPPORTING DOCUMENTATION

9

□ □ □ □ □ □ □ □ □ □ □

□ □ □ □ □ □ □ □

□ □ □ □ □ □ □ □

081285D06.SPC Analyzed by *fr*

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 13 / Solid

Sample ID: 0813514-6 FWHM CAL (855)

Sampling Start:	01/01/2008 10:00:00	Counting Start:	07/25/2008 10:15:36
Sampling Stop:	01/01/2008 10:00:00	Decay Time.	4.94E+003 Hrs
Buildup Time.	0.00E+000 Hrs	Live Time	5400 Sec
Sample Size	5.00E+002 g	Real Time	5558 Sec
Collection Efficiency	1.0000	Spc. File . . . . .	.081285D06.SPC

Detector # 6 (Detector 6)

081285D06.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813514-6 FWHM CAL (855)

Stds. Match Tolerance: 2.00 keV

Detector Number: 06 Calibration Date. . . 07/25/2008 10:15:36

FWHM(keV) = $0.73 + 0.012 \cdot \text{En} + 6.10\text{e-}04 \cdot \text{En}^2 + 0.00\text{e+}00 \cdot \text{En}^3$
(Where En = SQR(Energy in keV))

Pk. #	Energy (keV)	Measured FWHM(keV)	% Diff.	Calculated FWHM(keV)	% Diff.	Prev.Calc. FWHM(keV)
1	59.50	0.865	-0.75	0.859	4.77	0.902
2	88.04	0.891	0.63	0.897	4.08	0.935
3	122.06	0.935	0.35	0.938	3.43	0.972
4	165.85	0.999	-1.12	0.988	2.79	1.016
5	279.00	1.088	1.55	1.105	1.66	1.123
6	391.68	1.220	-0.63	1.212	0.94	1.223
7	661.64	1.453	-0.16	1.451	-0.04	1.450
8	898.02	1.635	0.79	1.648	-0.48	1.640
9	1173.21	1.873	-0.19	1.869	-0.75	1.855
10	1332.48	2.011	-0.85	1.994	-0.85	1.978
11	1836.01	2.372	0.36	2.381	-0.97	2.358

Calibration Results Saved.

OK
MC
7/25/08

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

RSO# 855

76484A-307
Sand in 16 Ounce PP MRP Jar

Customer: Paragon Analytics / Fort Collins, CO
P.O. No.: 72905 REL 12-13-07, Item 3
Calibration Date: 01-Jan-2008 12:00 EST **Grams of Master Source:** 0.011313

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST."

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					Type	u _A	u _B	U
Am-241	59.5	157860	—	1.322E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.671E+05	1.890E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.639E+04	9.773E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.219E+05	1.379E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.884E+05	3.263E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.718E+05	1.944E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.095E+05	1.239E+03	0.2	1.2	2.4	HPGe
Y-88	898.0	106.6	4.140E+05	4.684E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.071E+05	2.343E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.072E+05	2.344E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.376E+05	4.951E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

500 grams / 290 mL of customer supplied sand.
This standard will expire one year after the calibration date.

Source Prepared by: M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved: D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 1-23-08

End of Certificate

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab

GammaScan

Geo 13 / Solid

Sample ID: 0813514-7 FWHM CAL (855)

```

-----
Sampling Start:    01/01/2008 10:00:00 | Counting Start:    06/30/2008 11:23:26
Sampling Stop:    01/01/2008 10:00:00 | Decay Time. . . . . 4.35E+003 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 3900 Sec
Sample Size . . . . . 5.00E+002 g | Real Time . . . . . 4006 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 080881D07.SPC
-----

```

Detector #: 7 (Detector 7)

Energy(keV) = -1.33 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 06/30/2008

FWHM(keV) = 0.73 + 0.010*En + 8.16E-04*En^2 + 0.00E+00*En^3 12/04/2007

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

```

=====
PEAK SEARCH RESULTS
=====

```

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.50	121.44	24259	448	265	14106	0.83 a	HiResid
2	72.95	148.29	285	293	239	12705	0.62 a	
3	88.13	178.58	90935	719	322	19127	0.97 a	
4	122.22	246.66	52813	563	268	13284	1.00 a	HiResid
5	136.65	275.46	6574	334	240	10665	1.04 a	
6	166.10	334.26	48158	538	256	11165	1.10 a	HiResid
7	255.44	512.61	1220	235	184	6272	0.93 a	
8	279.60	560.84	14612	353	211	7075	1.26 a	
9	392.23	785.69	32627	417	171	5425	1.36 a	HiResid
10	511.65	1024.10	910	264	211	6289	2.08 a	
11	662.51	1325.27	39786	446	165	5007	1.57 a	HiResid
12	814.66	1629.03	634	238	191	5192	2.59 a	
13	898.95	1797.30	35694	432	171	4939	1.95 a	HiResid
14	933.86	1867.00	117	108	87	1866	0.90 a	
15	1174.25	2346.91	44537	458	145	3605	2.33 a	HiResid
16	1333.44	2664.72	39544	432	139	3058	2.54 a	HiResid
17	1359.22	2716.18	46	57	45	483	1.10 a	
18	1836.25	3668.52	19658	320	126	2216	3.21 a	HiResid

080881D07.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813514-7 FWHM CAL (855)

Stds. Match Tolerance: 2.00 keV

Detector Number: 07 Calibration Date. . . 06/30/2008 11:23:26

FWHM(keV) = $0.86 + -0.003 * En + 1.34e-03 * En^2 + 0.00e+00 * En^3$
(Where En = SQR(Energy in keV))

Pk. #	Energy (keV)	Measured FWHM(keV)	% Diff.	Calculated FWHM(keV)	% Diff.	Prev.Calc. FWHM(keV)
1	59.50	0.830	9.71	0.920	-7.36	0.857
2	88.04	0.969	-1.69	0.952	-6.31	0.896
3	122.06	1.001	-0.82	0.993	-5.63	0.940
4	165.85	1.097	-4.93	1.045	-5.27	0.993
5	279.00	1.264	-6.68	1.185	-5.58	1.122
6	391.68	1.358	-2.41	1.326	-6.61	1.244
7	661.64	1.567	6.14	1.670	-9.73	1.521
8	898.02	1.952	1.07	1.973	-12.42	1.755
9	1173.21	2.327	0.10	2.329	-15.24	2.021
10	1332.48	2.541	-0.20	2.536	-16.71	2.173
11	1836.01	3.215	-0.72	3.192	-20.68	2.645

Calibration Results Saved.

OK
MC
7/1/08



Eckert & Ziegler

Analytics

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

RSO# 855

76484A-307

Sand in 16 Ounce PP MRP Jar

Customer: Paragon Analytics / Fort Collins, CO

P.O. No.: 72905 REL 12-13-07, Item 3

Calibration Date: 01-Jan-2008 12:00 EST **Grams of Master Source:** 0.011313

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Revision 1, February, 1979, and compliance with ANSI N42.22-1995, "Traceability of Radioactive Sources to NIST."

Nuclide	Gamma-Ray Energy (keV)	Half-Life, Days	Master Source* yps/gram	This Source yps	Uncertainty, %			Calibration Method
					u _A	u _B	U	
Am-241	59.5	157860	—	1.322E+03	0.3	1.5	3.1	4π LS
Cd-109	88.0	462.60	1.671E+05	1.890E+03	0.9	1.7	3.8	HPGe
Co-57	122.1	271.79	8.639E+04	9.773E+02	0.6	1.3	2.9	HPGe
Ce-139	165.9	137.6	1.219E+05	1.379E+03	0.5	1.1	2.4	HPGe
Hg-203	279.2	46.61	2.884E+05	3.263E+03	0.5	1.1	2.4	HPGe
Sn-113	391.7	115.1	1.718E+05	1.944E+03	0.6	1.1	2.5	HPGe
Cs-137	661.7	10983	1.095E+05	1.239E+03	0.2	1.2	2.4	HPGe
Y-88	898.0	106.6	4.140E+05	4.684E+03	0.7	1.1	2.6	HPGe
Co-60	1173.2	1925.4	2.071E+05	2.343E+03	0.8	1.1	2.7	HPGe
Co-60	1332.5	1925.4	2.072E+05	2.344E+03	0.9	1.1	2.8	HPGe
Y-88	1836.1	106.6	4.376E+05	4.951E+03	0.7	1.1	2.6	HPGe

* Master Source refers to Analytics' 8-isotope mixture which is calibrated quarterly.

Calibration Methods: 4π LS - 4 pi Liquid Scintillation Counting, HPGe - High Purity Germanium Gamma-Ray Spectrometer, IC - Ionization Chamber. **Uncertainty:** U - Relative expanded uncertainty, k = 2. See NIST Technical Note 1297, "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results."

Comments:

500 grams / 290 mL of customer supplied sand.

This standard will expire one year after the calibration date.

Source Prepared by:

M. I. Taskaeva
M. I. Taskaeva, Radiochemist

QA Approved:

D. M. Montgomery
D. M. Montgomery, QA Manager

Date: 1-23-08

End of Certificate

Corporate Office

24937 Avenue Tibbitts Valencia, California 91355

Laboratory

1380 Seaboard Industrial Blvd. Atlanta, Georgia, 30318

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 1 / Water

Sample ID: 0813503-6 GEO 1 EFF CAL (867)

Sampling Start: 07/01/2008 10:00:00 | Counting Start: 08/06/2008 09:04:19
Sampling Stop: 07/01/2008 10:00:00 | Decay Time. 8.63E+002 Hrs
Buildup Time. 0.00E+000 Hrs | Live Time 3600 Sec
Sample Size 1.00E+000 L | Real Time 3814 Sec
Collection Efficiency 1.0000 | Spc. File 081369D06.SPC

Detector #: 6 (Detector 6)

Energy(keV) = -0.51 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 08/06/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	59.56	120.13	17131	438	289	16808	0.89 a	
2	70.83	142.66	2957	538	434	29792	1.25 a	
3	72.88	146.75	4560	393	304	18620	0.78 b	
4	82.43	165.84	1244	403	326	21448	0.80 a	
5	88.03	177.05	94105	723	314	19919	0.89 a	HiResid
6	122.12	245.21	74218	680	335	20708	0.98 a	
7	136.54	274.06	9702	447	330	20123	0.98 a	

081369D06.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Version 1.8.2

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET060802.BKG (080802-6 WEEKLY BACKGROUND)

Bkg.File Detector #: 6

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
2	70.83	2957	538	434	2956	538	434	
3	72.88	4560	393	304	4558	393	304	
5	88.03	94105	723	314	94102	723	314	
14	510.64	1362	319	255	1282	319	256	

20	898.11	90512	628	148	90508	628	148	
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 SEEKER C A L I B R A T I O N R E S U L T S Version 2.0.4

Sample ID: 0813503-6 GEO 1 EFF CAL (867)

Std. Match Tolerance: 2.00 keV

 Detector Number: 06 Calibration Date. . . 08/06/2008 09:04:19

Geometry File (D06)(Sh01).EFF ID. Geo 1 Eff Cal

Amount of Std. in Calib. Source: 1.000000 gm

Crossover: 180.00 keV

Below Crossover Efficiency Fit:

$$\text{Eff} = 10^{-2.91e+01 + 2.55e+01 \cdot \text{En} - 5.92e+00 \cdot \text{En}^2 + 0.00e+00 \cdot \text{En}^3}$$

(Where En = LOG(Energy in keV)) (Polynomial)

Above Knee Efficiency Fit:

$$\text{Eff} = 10^{-3.99e+00 + 3.72e+00 \cdot \text{En} - 1.60e+00 \cdot \text{En}^2 + 1.86e-01 \cdot \text{En}^3}$$
(Where En = LOG(Energy in keV)) (Polynomial)

Pk. #	Energy (keV)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.50	3.52e-03	1.13	3.56e-03	4.72	3.73e-03
2	88.04	1.46e-02	-4.14	1.40e-02	1.81	1.43e-02
3	122.06	2.30e-02	4.47	2.41e-02	0.25	2.41e-02
4	165.85	2.46e-02	-1.67	2.42e-02	-0.46	2.41e-02
5	279.00	1.84e-02	-0.07	1.84e-02	-0.53	1.83e-02
6	391.68	1.40e-02	0.31	1.41e-02	-1.00	1.39e-02
7	661.64	9.14e-03	-1.24	9.02e-03	-0.20	9.00e-03
8	898.02	6.80e-03	1.84	6.93e-03	0.48	6.96e-03
9	1173.21	5.55e-03	-0.61	5.52e-03	0.87	5.57e-03
10	1332.48	4.99e-03	-0.47	4.96e-03	0.91	5.01e-03
11	1836.01	3.83e-03	0.21	3.83e-03	0.40	3.85e-03

Calibration Results Saved.

OK
 MC
 09/10/08

Standards File. Gsstd01.std
 Assay Date 07/01/2008 10:00
 ID.: Geo 1 Std#867 1 L Mari. Mixed Gamma

Pk #	Nuclide	Energy	Halflife	Br.Ratio	dps/gm
1	Am-241	59.50	4.322E+02 yrs	0.35900	3768.80
2	Cd-109	88.04	4.626E+02 dys	0.03610	52326.87
3	Co-57	122.06	2.718E+02 dys	0.85510	1149.69
4	Ce-139	165.85	1.376E+02 dys	0.80350	1703.80
5	Hg-203	279.00	4.660E+01 dys	0.77300	4014.23
6	Sn-113	391.68	1.151E+02 dys	0.64900	2987.67
7	Cs-137	661.64	3.017E+01 yrs	0.85120	1422.70
8	Y-88	898.02	1.066E+02 dys	0.93400	4997.86
9	Co-60	1173.21	5.271E+00 yrs	0.99980	2267.45
10	Co-60	1332.48	5.271E+00 yrs	0.99990	2270.23
11	Y-88	1836.01	1.066E+02 dys	0.99380	4972.83



Eckert & Ziegler

Analytics

RSO # 867

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

77649A-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 73625, 5/19/08 Rel., Item 1

Calibration Date: 01-Jul-2008 12:00 EST **Grams of Master Source:** 0.011238

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The

Geometry 1 Calibration Verification: Gamma Mixed Nuclide Source													
CAL STD	867	Detector	6										
CAL VER		824											
FROM CALIBRATION CERTIFICATE				REF DATE : 7/1/2006									
				FROM ANALYTICS.LIB				EXPECTED ACTIVITY		count date	8/12/2008		
				Mass of Standard									# of half-lives expired
Isotope	KeV	Half Life(y)	Gammas/Sec.	Gamma Fraction:			DPS	pCi/L	Activity	Recovery	Pass/Fail		
Am-241	59.9	432.0000	1323	0.3590	1	L	3685.2	99601.0	99300	100%	Pass	0.00	
Cd-109	88	1.2666	1872	0.0361			51856.0	1401512.3	1450000	103%	Pass	1.67	
Co-57	122	0.7441	984.9	0.8551			1151.8	31129.6	28900	93%	Pass	2.84	
Ce-139	166	0.3768	1391	0.8035			1731.2	46788.5	NA	>5 h-lives	>5 h-lives	5.62	
Hg-203	279	0.1276	3088	0.7730			3994.8	107968.3	NA	>5 h-lives	>5 h-lives	16.59	
Sn-113	392	0.3151	1971	0.6490			3037.0	82080.5	NA	>5 h-lives	>5 h-lives	6.72	
Cs-137	662	30.0000	1256	0.8512			1475.6	39880.1	40000	100%	Pass	0.07	
Y-88	898	0.2919	4857	0.9340			5200.2	140546.3	NA	>5 h-lives	>5 h-lives	7.25	
Co-60	1173	5.2714	2377	1.0000			2377.0	64243.2	63700	99%	Pass	0.40	
Co-60	1332	5.2714	2374	1.0000			2374.0	64162.2	64000	100%	Pass	0.40	
Y-88	1836	0.2919	5084	0.9938			5115.7	138262.6	M	>5 h-lives	>5 h-lives	7.25	

OK
MC
09-10-08

081408D06.SPC Analyzed by *WSE*

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 1 / Water

Sample ID: 0813503-6 GEO 1 LCS VER (824)

Sampling Start: 07/01/2006 10:00:00 | Counting Start: 08/12/2008 08:18:54

081408D06.SPC Analyzed by

SEEKER B A C K G R O U N D S U B T R A C T R E S U L T S Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET060808.BKG (080808-6 WEEKLY BACKGROUND)

Bkg.File Detector #: 6

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
9	510.22	73	73	58	34	73	59	NET<CL
11	898.03	355	87	64	354	87	64	

 SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab
 GammaScan

Geo 1 / Water

Sample ID: 0813503-6 GEO 1 LCS VER (824)

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Sampling Start:    07/01/2006 10:00:00 | Counting Start:    08/12/2008 08:18:54
Sampling Stop:    07/01/2006 10:00:00 | Decay Time. . . . . 1.86e+004 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 1826 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 081408D06.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 6 (Detector 6)

Efficiency File: (D06)(Sh01).EFF (Geo 1 Eff Cal)

Eff=10^{^-2.91E+01 +2.55E+01*L +-5.92E+00*L^2 +0.00E+00*L^3} 08/06/2008

Eff.=10^{^-3.99E+00 +3.72E+00*L +-1.60E+00*L^2 +1.86E-01*L^3} Above 180.00 keV

Library File:ANALYTICAL.LIB (Analytical)

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MEASURED or MDA CONCENTRATIONS

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Nuclide	ENERGY E (keV)	Concentration (pCi/L)	MDA	Critical Level	Half-life (hrs)
Am-241	59.54	9.93E+04 +- 2.70E+03	2.70E+03	1.33E+03	3.79E+06
Cd-109	88.02	1.45E+06 +- 2.65E+04	2.09E+04	1.03E+04	1.11E+04
Co-57	122.07	2.89E+04 +- 1.02E+03	1.10E+03	5.43E+02	6.50E+03
Ce-139	165.85	5.10E+04 +- 5.58E+03	8.06E+03	3.98E+03	3.30E+03
Sn-113	391.68	9.15E+04 +- 1.95E+04	2.97E+04	1.46E+04	2.76E+03
Cs-137	661.62	4.00E+04 +- 5.96E+02	2.80E+02	1.37E+02	2.64E+05
Y-88	Average:x	1.39E+05 +- 1.75E+04	. . . . .	. . . . .	2.56E+03
	898.02	1.25E+05 +- 3.07E+04	4.65E+04	2.28E+04	2.56E+03
	1836.01	1.46E+05 +- 2.13E+04	1.82E+04	8.30E+03	2.56E+03
Co-60	Average:x	6.38E+04 +- 7.06E+02	. . . . .	. . . . .	4.62E+04
	1173.21	6.37E+04 +- 9.78E+02	3.42E+02	1.66E+02	4.62E+04
	1332.48	6.40E+04 +- 1.02E+03	2.13E+02	1.01E+02	4.62E+04
Hg-203	279.18	MDA	1.87E+07	9.22E+06	1.12E+03

MEASURED TOTAL: 1.97E+06 +- 7.41E+04 pCi/L

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UNKNOWN, SUM or ESCAPE PEAKS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
4	136.46	273.81	647	130	99	1799	1.01	Unknown
5	145.58	292.06	78	118	96	1715	0.90	Deleted

081408D06.SPC Analyzed by

UNKNOWN, SUM or ESCAPE PEAKS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
7	225.18	451.23	42	76	62	935	0.53	Deleted
9	510.22	1021.20	34	73	59	716	0.96	Deleted

c:\SEEKER\BIN\081408d06.res Analysis Results Saved.



1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analytiscinc.com

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
JUB

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 1 / Water

Sample ID: 0813503-7 GEO 1 EFF CAL (848)

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Sampling Start:    07/01/2007 10:00:00 | Counting Start:    07/01/2008 12:14:31
Sampling Stop:    07/01/2007 10:00:00 | Decay Time. . . . . 8.79E+003 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 5400 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 5517 Sec
Collection Efficiency . . . . 1.0000 | Spc. File . . . . . 080889D07.SPC
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Detector #: 7 (Detector 7)

Energy(keV) = -1.37 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 07/01/2008

FWHM(keV) = 0.86 + -0.003*En + 1.34E-03*En^2 + 0.00E+00*En^3 06/30/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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PEAK SEARCH RESULTS
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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	49.19	100.99	606	350	285	16332	0.79	a Wide Pk
2	51.15	104.90	944	783	642	45729	2.25	b
3	59.36	121.32	50400	565	282	15979	0.83	a HiResid
4	87.95	178.42	126102	817	333	20456	0.94	a
5	122.02	246.48	63088	585	247	11283	0.97	a HiResid
6	136.48	275.37	8094	322	220	8951	1.00	a
7	157.80	317.96	293	330	270	11531	1.28	a
8	165.88	334.10	34899	454	212	8316	0.93	a HiResid
9	255.34	512.79	866	263	211	7569	1.10	a
10	279.37	560.81	1307	213	164	5708	1.03	a
11	310.73	623.45	246	144	115	3275	0.67	a
12	356.79	715.46	100	134	109	2910	0.64	a NET< CL
13	391.95	785.70	19577	353	177	5804	1.30	a
14	511.15	1023.82	650	334	272	8738	2.79	a Wide Pk
15	512.26	1026.03	125	131	106	2570	0.86	b
16	662.10	1325.34	70037	560	150	4370	1.50	a HiResid
17	814.31	1629.40	250	161	130	3560	1.52	a
18	898.42	1797.44	18034	328	154	4807	1.60	a HiResid
19	1173.63	2347.19	70878	561	146	3803	2.16	a HiResid
20	1332.74	2665.03	63621	524	116	2202	2.39	a HiResid
21	1835.32	3668.99	10478	214	51	381	2.92	a HiResid

080889D07.SPC Analyzed by

SEEKER BACKGROUND SUBTRACT RESULTS Version 1.8.2

Paragon Analytics, Div. of DataChem Lab
GammaScan

Background File: DET070630.BKG (080630-7 WEEKLY BACKGROUND)

Bkg.File Detector #: 7

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BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
1	49.19	606	350	285	604	350	285	
4	87.95	126102	817	333	126100	817	333	
14	511.15	650	334	272	508	335	273	
18	898.42	18034	328	154	18027	328	155	

080889D07.SPC Analyzed by

SEEKER CALIBRATION RESULTS Version 2.0.4

Sample ID: 0813503-7 GEO 1 EFF CAL (848)

Stds. Match Tolerance: 2.00 keV

Detector Number: 07 Calibration Date. . . 07/01/2008 12:14:31

Geometry File (D07)(Sh01).EFF ID. Geo 1 Eff CaL

Amount of Std. in Calib. Source: 1.000000 gm

Eff = 1 / [2.82e-03*En^-3.81e+00 + 1.38e+02*En^ 8.21e-01]
(Where En = Energy in MeV) (Exponential)

Pk. #	Energy (keV)	Measured Efficiency	% Difference	Calculated Efficiency	% Difference	Prev.Calc. Efficiency
1	59.50	6.78e-03	2.41	6.95e-03	-1.61	6.84e-03
2	88.04	2.13e-02	-2.56	2.08e-02	1.51	2.11e-02
3	122.06	2.98e-02	1.67	3.04e-02	-0.46	3.02e-02
4	165.85	2.89e-02	1.37	2.93e-02	-2.29	2.86e-02
5	391.68	1.66e-02	-5.86	1.56e-02	-1.92	1.54e-02
6	661.64	1.05e-02	-2.82	1.02e-02	-0.85	1.01e-02
7	898.02	7.59e-03	4.21	7.93e-03	-0.21	7.91e-03
8	1173.21	6.40e-03	-0.46	6.37e-03	0.34	6.39e-03
9	1332.48	5.73e-03	0.07	5.73e-03	0.61	5.77e-03
10	1836.01	4.17e-03	5.31	4.41e-03	1.27	4.46e-03

Calibration Results Saved.

OK
MC
7/13/08

Standards File. Gsstd01.std
 Assay Date 07/01/2007 10:00
 ID.: Geo 1 Std#848 1 L Mari. Mixed Gamma

Pk #	Nuclide	Energy	Halflife	Br.Ratio	dps/gm
1	Am-241	59.50	4.322E+02 yrs	0.35900	3838.40
2	Cd-109	88.04	4.626E+02 dys	0.03610	52437.70
3	Co-57	122.06	2.718E+02 dys	0.85510	1164.20
4	Ce-139	165.85	1.376E+02 dys	0.80350	1758.60
5	Hg-203	279.00	4.660E+01 dys	0.77300	3825.40
6	Sn-113	391.68	1.151E+02 dys	0.64900	3057.00
7	Cs-137	661.64	3.017E+01 yrs	0.85120	1488.50
8	Y-88	898.02	1.066E+02 dys	0.93400	5081.40
9	Co-60	1173.21	5.271E+00 yrs	0.99980	2342.00
10	Co-60	1332.48	5.271E+00 yrs	0.99990	2346.00
11	Y-88	1836.01	1.066E+02 dys	0.99380	5055.30



Eckert & Ziegler

Analytics

RSO# 848
rec 7-23-07

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318
Tel 404-352-8677
Fax 404-352-2837
www.analyticsinc.com

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

75354-307

1.0 Liter Solid in 138G GA-MA Beaker

Customer: Paragon Analytics

P.O. No.: 72908, Item 1

Calibration Date: 01-Jul-2007 12:00 EST **Grams of Master Source:** 0.011424

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solutions. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The

Geometry 1 Calibration Verification: Gamma Mixed Nuclide Source									
CAL STD	848	Detector	7						
CAL VER		824		REF DATE :	7/1/2006				
FROM CALIBRATION CERTIFICATE				FROM ANALYTICS.LIB					
Isotope	KeV	Half Life(y)	Gamm/sec.	Gamma Fraction:	Mass of Standard	EXPECTED ACTIVITY		pCi/L	Activity
Am-241	59.9	432.0000	1323	0.3590	1	L	Am-241	3685.2	102000
Cd-109	88	1.2666	1872	0.0361			Cd-109	51856.0	1460000
Co-57	122	0.7441	984.9	0.8551			Co-57	1151.8	31400
Ce-139	166	0.3768	1391	0.8035			Ce-139	1731.2	51400
Hg-203	279	0.1276	3088	0.7730			Hg-203	3994.8	NA
Sn-113	392	0.3151	1971	0.6490			Sn-113	3037.0	86900
Cs-137	662	30.0000	1256	0.8512			Cs-137	1475.6	42900
Y-88	898	0.2919	4857	0.9340			Y-88	5200.2	136000
Co-60	1173	5.2714	2377	1.0000			Co-60	2377.0	66600
Co-60	1332	5.2714	2374	1.0000			Co-60	2374.0	64900
Y-88	1836	0.2919	5084	0.9938			Y-88	5115.7	130000
								Recovery	Pass/Fail
								102%	Pass
								104%	Pass
								101%	Pass
								110%	Pass
								>5 h-lives	>5 h-lives
								106%	Pass
								108%	Pass
								97%	Pass
								104%	Pass
								101%	Pass
								94%	Pass
									# of half-lives expired
									0.00
									1.58
									2.70
									5.33
									15.73
									6.37
									0.07
									6.87
									0.38
									0.38
									6.87

OK
MC
2/13/08

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Geo 1 / Water

Sample ID: 0813503-7 GEO 1 LCS VER (824)

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Sampling Start:      07/01/2006 10:00:00 | Counting Start:      07/03/2008 13:16:28
Sampling Stop:       07/01/2006 10:00:00 | Decay Time. . . . . 1.76E+004 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 1828 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 080906D07.SPC
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Detector #: 7 (Detector 7)

Energy(keV) = -1.34 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 07/03/2008

FWHM(keV) = 0.86 + -0.003*En + 1.34E-03*En^2 + 0.00E+00*En^3 06/30/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

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=====
PEAK SEARCH RESULTS
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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	49.78	102.11	249	179	145	4209	0.89 a	
2	59.39	121.30	16933	310	138	3854	0.86 a	HiResid
3	87.95	178.35	24434	360	147	3987	0.91 a	
4	122.01	246.38	8337	226	109	2203	0.97 a	
5	136.49	275.30	1041	142	104	2008	1.06 a	
6	165.91	334.07	2011	153	102	1907	1.02 a	
7	391.80	785.26	712	114	83	1362	1.07 a	
8	548.93	1099.13	66	61	48	575	0.89 a	
9	661.92	1324.82	23696	323	81	1202	1.59 a	HiResid
10	898.07	1796.50	636	123	92	1565	1.90 a	
11	1173.28	2346.23	21694	307	71	900	2.16 a	HiResid
12	1332.34	2663.92	19021	281	46	359	2.30 a	HiResid
13	1834.87	3667.70	323	42	19	51	3.01 a	

080906D07.SPC Analyzed by

SEEKER B A C K G R O U N D S U B T R A C T R E S U L T S Vers. 2.2.1

Paragon Analytics, Div. of DataChem Lab

GammaScan

Background File: DET070630.BKG (080630-7 WEEKLY BACKGROUND)

Bkg.File Detector #: 7

=====

BACKGROUND SUBTRACT RESULTS

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PK#	ENERGY (keV)	OLD NET COUNTS	OLD UN- CERTAINTY	OLD CR.LEVEL	NEW NET COUNTS	NEW UN- CERTAINTY	NEW CR.LEVEL	FLAG
1	49.78	249	179	145	248	179	145	
3	87.95	24434	360	147	24434	360	147	
10	898.07	636	123	92	634	123	92	

SEEKER F I N A L A C T I V I T Y R E P O R T Version 2.2.1

Paragon Analytics, Div. of DataChem Lab

GammaScan

Geo 1 / Water

Sample ID: 0813503-7 GEO 1 LCS VER (824)

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Sampling Start:      07/01/2006 10:00:00 | Counting Start:      07/03/2008 13:16:28
Sampling Stop:       07/01/2006 10:00:00 | Decay Time. . . . . 1.76e+004 Hrs
Buildup Time. . . . . 0.00e+000 Hrs | Live Time . . . . . 1800 Sec
Sample Size . . . . . 1.00e+000 L | Real Time . . . . . 1828 Sec
Collection Efficiency . . . . . 1.0000 | Spectrum File . . . . . 080906D07.SPC
Cr. Level Confidence Interval: 95 % | Det. Limit Confidence Interval: 95 %
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Detector #: 7 (Detector 7)

Efficiency File: (D07)(Sh01).eff (Geo 1 Eff CaL)

*Eff.=1/[2.82E-03*En^-3.81E+00 + 1.38E+02*En^8.21E-01] 07/01/2008

Library File:ANALYTICAL.LIB (Analytical)

===== MEASURED or MDA CONCENTRATIONS =====

Nuclide	ENERGY E (keV)	N T	Concentration (pCi/L)	MDA	Critical Level	Halflife (hrs)
Am-241	59.54	1.02E+05 +- 1.87E+03	1.68E+03	8.33E+02	3.79E+06	
Cd-109	88.02	1.46E+06 +- 2.15E+04	1.77E+04	8.78E+03	1.11E+04	
Co-57	122.07	3.14E+04 +- 8.51E+02	8.34E+02	4.12E+02	6.50E+03	
Ce-139	165.85	5.14E+04 +- 3.90E+03	5.26E+03	2.60E+03	3.30E+03	
Sn-113	391.68	8.69E+04 +- 1.40E+04	2.06E+04	1.02E+04	2.76E+03	
Cs-137	661.62	4.29E+04 +- 5.85E+02	2.97E+02	1.46E+02	2.64E+05	
Y-88	Average:x	1.36E+05 +- 1.48E+04	. . . .	. . . .	2.56E+03
	898.02	1.51E+05 +- 2.92E+04	4.45E+04	2.19E+04	2.56E+03	
	1836.01	1.30E+05 +- 1.71E+04	1.60E+04	7.48E+03	2.56E+03	
Co-60	Average:x	6.58E+04 +- 6.73E+02	. . . .	. . . .	4.62E+04
	1173.21	6.66E+04 +- 9.43E+02	4.46E+02	2.19E+02	4.62E+04	
	1332.48	6.49E+04 +- 9.60E+02	3.22E+02	1.57E+02	4.62E+04	
Hg-203	279.18	MDA	. . . .	9.35E+06	4.61E+06

MEASURED TOTAL: 1.98E+06 +- 5.81E+04 pCi/L

===== UNKNOWN, SUM or ESCAPE PEAKS =====

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
1	49.78	102.11	248	179	145	4209	0.89	Unknown
5	136.49	275.30	1041	142	104	2008	1.06	Unknown
8	548.93	1099.13	66	61	48	575	0.89	Unknown

080906D07.SPC Analyzed by

CERTIFICATE OF CALIBRATION
Standard Radionuclide Source

73487-307

RSO# 824 Rec'd 8/29/06
JUB

1.0 Solid in 138G GA-MA Beaker

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytics maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

US Patent 4,430,258; UK Patent GB2,149,194B; CA Patent 1,196,776.
Density of solid matrix 1.15 g/cc.

Calibration date: July 1, 2006 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1323	3.0
Cd-109	88	462.6 d	1872	3.3
Co-57	122	271.79 d	984.9	3.0
Ce-139	166	137.6 d	1391	2.8
Hg-203	279	46.61 d	3088	2.7
Sn-113	392	115.1 d	1971	2.6
Cs-137	662	30.07 y	1256	3.0
Y-88	898	106.6 d	4857	2.6
Co-60	1173	5.2714 y	2377	2.7
Co-60	1332	5.2714 y	2374	2.6
Y-88	1836	106.6 d	5084	2.6

P O NUMBER 71239, Rel. 7/31/06, Item 1

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva, Radiochemist

Q A APPROVED: UM [Signature] 8-24-06

This standard will expire one year after the calibration date.

Reverified Exp 7/26/08
w 5/12/08

□ □ □ □ □ □ □ □ □ □

ALS - Fort Collins

Gamma Spectrometer Calibration Log

Date: 12/26/08

Reviewed By/Date: MDV 12-27-08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	JP	/	/	/	/					
2.		JP	MDV	JP	JP					
3.		JP	↓	JP	JP					
4.		JP	↓	JP	JP					
5.	JP	/	/	/	/					
6.		JP	MDV	JP	JP					
7.		JP	↓	JP	JP					
8.		JP	/x	JP	JP					
9.		JP	MDV	JP	JP					
10.	JP	JP	/x	/	/					

** Corrective Action: 0 Recount det. 3; Peak split
582.47 keV, 583.85 keV.

MDV 12-27-08

x Det. 8 Failed / Recount

50 → 150 keV bounds
150 → 250 keV
250 → 500 keV ↓

x Det. 10 Failed

~~40 → 50 keV~~ MDV 12-27-08
40 → 50 keV bounds
50 → 150 keV bounds.

SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Weekly Background Check

Sample ID: 081226-6 WEEKLY BKG

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Sampling Start:   12/26/2008 12:00:00 | Counting Start:   12/26/2008 12:52:23
Sampling Stop:    12/26/2008 12:00:00 | Decay Time. . . . . 8.73E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 60048 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081968D06.SPC
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```

Detector #: 6 (Detector 6)

Energy(keV) = -0.59 + 0.500*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 12/26/2008

FWHM(keV) = 0.73 + 0.012*En + 6.10E-04*En^2 + 0.00E+00*En^3 07/25/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

PEAK SEARCH RESULTS

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=====
PK.   ENERGY   ADDRESS   NET/MDA   UN-   C.L.   BKG   FWHM
#     (keV)     CHANNEL   COUNTS   CERTAINTY  COUNTS  COUNTS (keV)  FLAG
-----
 1     53.97     109.08        57        76        61       761    0.88 a NET< CL
 2     66.44     134.00       107        71        56       697    0.66 a HiResid
 3     69.44     140.00         5        56        46       523    0.44 b NET< CL
                               HiResid
 4     74.76     150.64        66        55        43       464    0.44 a
 5     76.99     155.10        69        77        62       773    0.79 b
 6     92.64     186.39       142        62        48       501    0.66 a
 7    104.76     210.61        54        58        46       476    0.71 a
 8    139.68     280.43        87        50        38       365    0.50 a
 9    155.15     311.35        20        49        39       381    0.49 a NET< CL
10    168.89     338.81        50        57        45       457    0.67 a
11    175.41     351.86        25        86        71       848    1.10 a NET< CL
12    185.72     372.46       168        87        68       788    1.12 a
13    198.17     397.36       210        71        53       565    0.79 a
14    202.87     406.75        46        93        76       904    1.34 b NET< CL
15    238.55     478.08        86        65        51       528    0.85 a
16    295.13     591.18       101        84        67       715    1.28 a
17    330.46     661.82        43        69        56       533    1.21 a NET< CL
18    351.90     704.67       156        66        50       495    1.06 a
19    500.95    1002.64        40        57        45       381    1.28 a NET< CL
20    511.04    1022.81     1326       116        74       744    2.36 a Wide Pk
21    537.11    1074.94        41        51        40       302    1.35 a
22    558.37    1117.43       184        58        42       324    1.23 a
23    569.54    1139.77        94        47        35       260    1.04 a
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PEAK SEARCH RESULTS

PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
24	583.51	1167.70	89	55	42	333	1.26	a
25	596.53	1193.72	93	94	76	767	2.24	a Wide Pk
26	609.22	1219.09	93	60	47	406	1.29	a
27	617.12	1234.89	38	49	39	300	1.16	a NET< CL
28	669.84	1340.27	32	44	35	242	1.19	a NET< CL
29	694.12	1388.81	149	108	87	824	3.11	a Wide Pk
30	802.95	1606.38	128	47	34	222	1.48	a
31	897.98	1796.35	69	46	35	215	1.84	a
32	911.63	1823.65	62	45	34	208	1.78	a
33	961.68	1923.71	54	35	26	144	1.23	a
34	1120.18	2240.55	42	32	24	120	1.34	a
35	1460.78	2921.45	363	48	23	101	2.01	a
36	1764.41	3528.45	48	29	21	77	2.17	a

081968D06.SPC Analyzed by

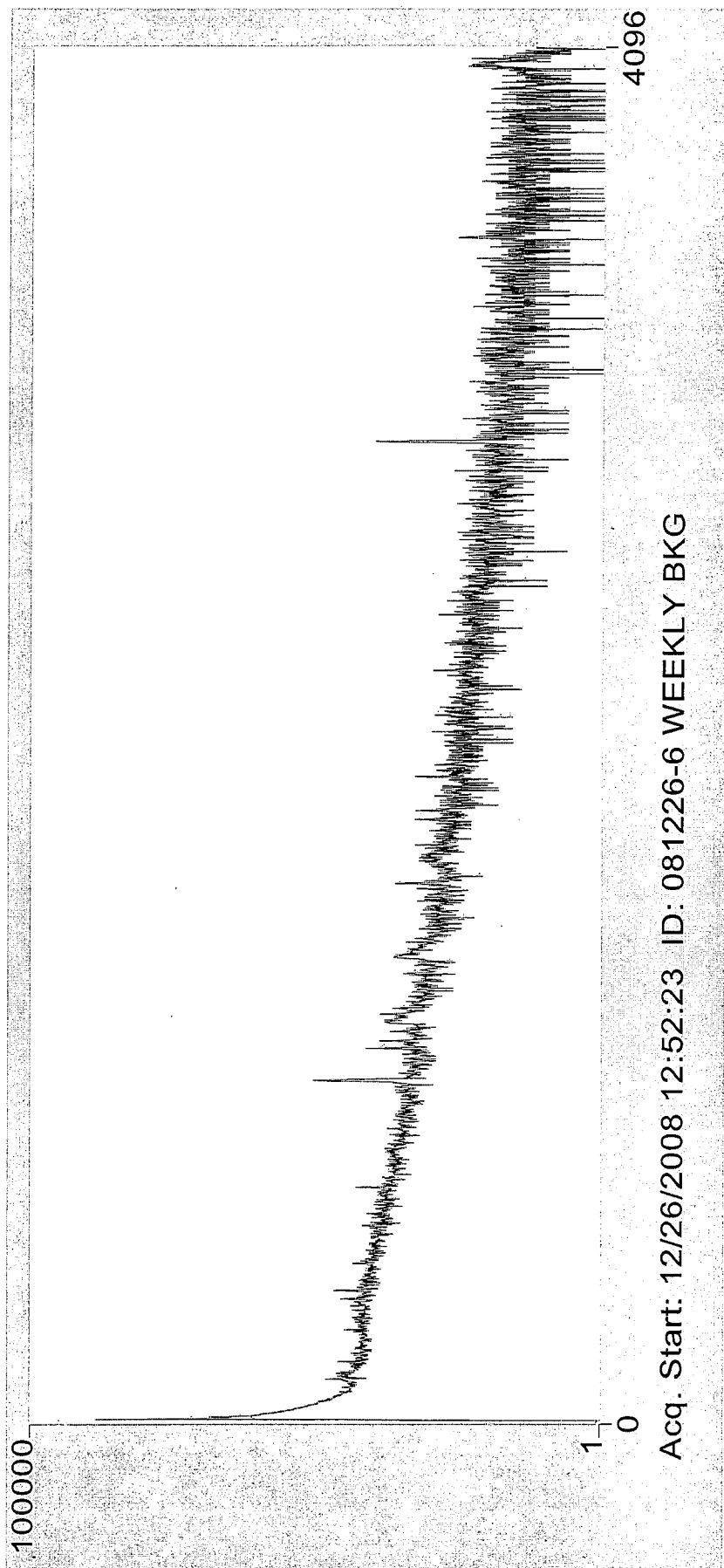
SEEKER B A C K G R O U N D Q . C . A N A L Y S I S Version 2.2.2

ID: 081226-6 WEEKLY BKG

Detector # 6 Background Q.C. Analysis for 12/26/2008 12:52:23

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
10	50-> 150 keV Bkg	26.974	N.A.	Pass	N.A.
11	150-> 250 keV Bkg	22.770	N.A.	Pass	N.A.
12	250-> 500 keV Bkg	33.961	N.A.	Pass	N.A.
13	500->1000 keV Bkg	33.019	N.A.	Pass	N.A.
14	1000->2000 keV Bkg	17.850	N.A.	Pass	N.A.
15	40-> 50 keV Bkg	3.787	N.A.	Pass	N.A.

Q.C. Results Saved.



SEEKER G A M M A A N A L Y S I S R E S U L T S PS Version 1.8.4

Paragon Analytics, Div. of DataChem Lab
GammaScan

Weekly Background Check

Sample ID: 081226-7 WEEKLY BKG

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Sampling Start:   12/26/2008 12:00:00 | Counting Start:   12/26/2008 12:52:37
Sampling Stop:    12/26/2008 12:00:00 | Decay Time. . . . . 8.77E-001 Hrs
Buildup Time. . . . . 0.00E+000 Hrs | Live Time . . . . . 60000 Sec
Sample Size . . . . . 1.00E+000 L | Real Time . . . . . 60214 Sec
Collection Efficiency . . . . . 1.0000 | Spc. File . . . . . 081775D07.SPC
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Detector #: 7 (Detector 7)

Energy(keV) = -1.43 + 0.501*Ch + 0.00E+00*Ch^2 + 0.00E+00*Ch^3 12/26/2008

FWHM(keV) = 0.86 + -0.003*En + 1.34E-03*En^2 + 0.00E+00*En^3 06/30/2008

Where En = Sqrt(Energy in keV)

Search Sensitivity: 1.00 | Sigma Multiplier: 2.00 | Search Start/End: 80/4000

PEAK SEARCH RESULTS

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PK.   ENERGY   ADDRESS   NET/MDA   UN-   C.L.   BKG   FWHM
#     (keV)     CHANNEL   COUNTS   CERTAINTY   COUNTS   COUNTS   (keV)   FLAG
-----
 1     62.97     128.61      132       59       45      488    0.46 a HiResid
 2     66.28     135.22      195       72       54      651    0.74 b HiResid
 3     70.10     142.84       41      122      100     1464    1.48 c NET< CL
                               HiResid
 4     74.72     152.08      103       77       61      761    0.83 a
 5     77.06     156.76      137       78       61      761    0.80 b
 6     84.35     171.30       95       72       57      648    0.78 a
 7     86.88     176.36       79       71       57      648    0.86 b
 8     92.57     187.72      514       98       71      866    1.10 a
 9    139.64     281.73      162       87       69      803    1.14 a
10    143.70     289.84       52       66       53      573    0.81 b NET< CL
11    185.69     373.68      321       82       61      687    1.04 a
12    198.31     398.89      152       69       53      573    0.79 a
13    229.59     461.37       39       43       34      288    0.57 a
14    238.74     479.63      236       62       45      441    0.68 a
15    280.54     563.12       28       61       49      511    0.99 a NET< CL
16    295.42     592.83      144       69       53      558    1.22 a
17    310.99     623.92       46       45       35      308    0.62 a
18    338.48     678.83       69       51       40      361    0.84 a
19    352.12     706.05      223       66       48      459    1.13 a
20    511.25    1023.86     1696      128       81      802    2.70 a Wide Pk
21    538.20    1077.68       28       45       36      284    1.18 a NET< CL
22    558.86    1118.93      193       56       40      322    1.28 a
23    570.09    1141.36      100       53       41      338    1.29 a
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PEAK SEARCH RESULTS

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PK. #	ENERGY (keV)	ADDRESS CHANNEL	NET/MDA COUNTS	UN- CERTAINTY	C.L. COUNTS	BKG COUNTS	FWHM (keV)	FLAG
24	583.79	1168.72	150	56	42	338	1.50	a
25	596.53	1194.17	78	77	62	593	2.21	a
26	609.55	1220.17	160	63	48	467	1.32	a
27	669.85	1340.59	43	42	33	233	1.19	a
28	803.57	1607.63	161	63	48	371	2.51	a
29	898.83	1797.87	59	41	31	197	1.56	a
30	911.67	1823.52	60	33	24	139	1.21	a
31	962.49	1925.01	55	48	38	254	2.08	a
32	1064.02	2127.77	34	30	23	119	1.20	a
33	1460.83	2920.23	153	40	26	118	2.14	a

081775D07.SPC Analyzed by

SEEKER B A C K G R O U N D Q . C . A N A L Y S I S Version 2.2.2

ID: 081226-7 WEEKLY BKG

Detector # 7 Background Q.C. Analysis for 12/26/2008 12:52:37

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
10	50-> 150 keV Bkg	26.702	N.A.	Pass	N.A.
11	150-> 250 keV Bkg	21.993	N.A.	Pass	N.A.
12	250-> 500 keV Bkg	32.181	N.A.	Pass	N.A.
13	500->1000 keV Bkg	34.314	N.A.	Pass	N.A.
14	1000->2000 keV Bkg	19.637	N.A.	Pass	N.A.
15	40-> 50 keV Bkg	3.374	N.A.	Pass	N.A.

Q.C. Results Saved.

4096

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

PAI 0720

66354A-307

215 Grams of Sand in Metal Can

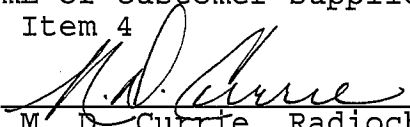
This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytix maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: July 1, 2003 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1316	3.0
Cd-109	88	462.6 d	1879	3.3
Co-57	122	271.79 d	1042	2.8
Ce-139	166	137.6 d	1432	2.8
Hg-203	279	46.61 d	3223	2.7
Sn-113	392	115.1 d	1978	2.6
Cs-137	662	30.07 y	1272	3.0
Y-88	898	106.6 d	5106	2.6
Co-60	1173	5.2714 y	2424	2.7
Co-60	1332	5.2714 y	2449	2.6
Y-88	1836	106.6 d	5335	2.6

Approximately 126.5 mL of customer supplied sand.
P O NUMBER EW060303, Item 4

SOURCE PREPARED BY:


M. D. Currie, Radiochemist

Q A APPROVED:

 8-1-03

This standard will expire one year after the calibration date.



RSO # 767
Rec'd 8/13/04
JOS

1380 Seaboard Industrial Blvd.
Atlanta, Georgia 30318 • U.S.A.

Phone (404) 352-8677

Fax (404) 352-2837

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

68681-307

215 Grams of Sand in Metal Can

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytical maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: July 1, 2004 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1355	3.0
Cd-109	88	462.6 d	1900	3.3
Co-57	122	271.79 d	995.1	3.0
Ce-139	166	137.6 d	1411	2.8
Hg-203	279	46.61 d	3241	2.7
Sn-113	392	115.1 d	1939	2.6
Cs-137	662	30.07 y	1247	3.0
Y-88	898	106.6 d	4853	2.6
Co-60	1173	5.2714 y	2457	2.7
Co-60	1332	5.2714 y	2474	2.6
Y-88	1836	106.6 d	5064	2.6

140 mL of customer supplied sand.

P O NUMBER 70564, Item 4

SOURCE PREPARED BY:

M. D. Currie for
M. D. Currie, Radiochemist

Q A APPROVED:

M. D. Currie 8-9-04

This standard will expire one year after the calibration date.

$\approx 203 \mu\text{Ci}$

PAT ID 0636
rec'd 8-02-02

CERTIFICATE OF CALIBRATION

Standard Radionuclide Source

64122-307

215 Grams of Sand in Metal Can

This standard radionuclide source was prepared using aliquots measured gravimetrically from master radionuclide solution sources. The Am-241 was calibrated by 4 pi alpha liquid scintillation counting. All other radionuclides were calibrated using a germanium gamma spectrometer system. Calibration and purity were checked using a germanium gamma spectrometer system. At the time of calibration no interfering gamma-ray emitting impurities were detected. The gamma-ray emission rates for the most intense gamma-ray lines are given. Analytix maintains traceability to the National Institute of Standards and Technology through a Measurements Assurance Program as described in USNRC Regulatory Guide 4.15, Rev. 1, February, 1979.

Calibration date: July 1, 2002 12:00 EST

ISOTOPE	GAMMA-RAY ENERGY	HALF-LIFE	GAMMA-RAYS PER SECOND	TOTAL UNCERTAINTY %
Am-241	59.5	432 y	1301	5.0
Cd-109	88	462.6 d	1882	5.0
Co-57	122	271.79 d	994.2	4.7
Ce-139	166	137.6 d	1420	4.3
Hg-203	279	46.61 d	3085	4.1
Sn-113	392	115.1 d	2094	4.1
Cs-137	662	30.07 y	1320	4.8
Y-88	898	106.6 d	4847	4.2
Co-60	1173	5.2714 y	2354	4.1
Co-60	1332	5.2714 y	2382	4.2
Y-88	1836	106.6 d	5068	4.0

Approximately 140 mL customer supplied sand.
P O NUMBER EW060602, Item 4

SOURCE PREPARED BY: M. Taskaeva
M. Taskaeva Radiochemist

Q A APPROVED: rec'd 7/31/02

This standard will expire one year after the calibration date.

RSO # 720 was opened and split into multiple LSC vials, as shown

720.3020.47	-1	35.8071 g	(Bal 12)
	-2	36.1586	
	-3	36.1325	
	-4	36.0040	
	-5	36.4197	
	-6	34.5663	

These will be used as δ daily check sources

[Signature]
10/30/06

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Read and Understood By

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10/30/06

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RSO #767 was opened and split into multiple LSC vials, to be used as 8 check sources, as shown

767.3020.48-7	36.6640 g	(Bal 12)
8	36.1856 g	
9	36.3376 g	
10	35.9931 g	
11	36.7952 g	
12	33.1100 g	

JSB
10/30/06

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RSO # 636 was opened and split into multiple LSC vials, to be used as 8 daily check sources, as shown

636.3020.49-13	34.2237 g	(Bal 12)
↓ 14	33.7917 g	↓
15	34.6628	
16	34.1622	
17	34.2401	
18	34.6838	

The remaining 9.1386g was transferred to a 200 ml plastic beaker and marked for disposal.

~~10/30/06~~

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Gamma Spectrometer Calibration Log

Date: 12-30-08

Reviewed By/Date: WTV 12-30-08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	WTV			/	/					
2.				WTV	WTV					
3.				WTV	WTV					
4.				↓	↓					
5.	WTV			/	/					
6.				WTV	WTV					
7.				↓	↓					
8.	WTV			↓	↓					
9.				WTV	↓					
10.	WTV			WTV	↓					

** Corrective Action:

 SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 6 Detector Q.C. Analysis for 12/30/2008 08:17:31

Standards File #: 98 (Daily Performance Check)

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.077	N.A.	Pass	N.A.
2	60 keV FWHM	8.291E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	9.705E-03	N.A.	Pass	N.A.
4	662 keV Centroid	1323.894	N.A.	Pass	N.A.
5	662 keV FWHM	1.400	N.A.	Pass	N.A.
6	662 keV Efficiency	2.775E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2665.128	N.A.	Pass	N.A.
8	1332 keV FWHM	1.956	N.A.	Pass	N.A.
9	1332 keV Efficiency	3.766E-02	N.A.	Pass	N.A.

Q.C. Results Saved.

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 7 Detector Q.C. Analysis for 12/30/2008 08:17:40

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	121.434	N.A.	Pass	N.A.
2	60 keV FWHM	8.533E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.424E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1325.055	N.A.	Pass	N.A.
5	662 keV FWHM	1.809	N.A.	Pass	N.A.
6	662 keV Efficiency	1.611E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2664.335	N.A.	Pass	N.A.
8	1332 keV FWHM	2.772	N.A.	Pass	N.A.
9	1332 keV Efficiency	7.844E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

ALS - Fort Collins

Gamma Spectrometer Calibration Log

Date: 12-31-08

Reviewed By/Date: WAV 12-31-08

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	WAV			/	/					
2.				WAV	WAV					
3.				↓	↓					
4.				↓	/	1332 Kev Efficiency	WAV			
5.	WAV			/	/					
6.				WAV	WAV					
7.				↓	/	1332 Kev Efficiency	WAV			
8.	WAV			↓	/	662 Kev Centroid	/	662 Kev Centroid 662 Kev FWHM		
9.					WAV					
10.	WAV			↓	↓					

** Corrective Action:

371729 A

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 6 Detector Q.C. Analysis for 12/31/2008 08:29:58

Standards File #: 98 (Daily Performance Check)

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	120.103	N.A.	Pass	N.A.
2	60 keV FWHM	8.101E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.003E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1323.799	N.A.	Pass	N.A.
5	662 keV FWHM	1.439	N.A.	Pass	N.A.
6	662 keV Efficiency	2.953E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2665.172	N.A.	Pass	N.A.
8	1332 keV FWHM	1.999	N.A.	Pass	N.A.
9	1332 keV Efficiency	3.753E-02	N.A.	Pass	N.A.

Q.C. Results Saved.

081788D07.SPC Analyzed by *WSP*

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 7 Detector Q.C. Analysis for 12/21/2008 08:20:07

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 7 Detector Q.C. Analysis for 12/31/2008 08:49:53

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	121.429	N.A.	Pass	N.A.
2	60 keV FWHM	8.772E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.394E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1324.772	N.A.	Pass	N.A.
5	662 keV FWHM	1.805	N.A.	Pass	N.A.
6	662 keV Efficiency	1.636E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2663.960	N.A.	Pass	N.A.
8	1332 keV FWHM	2.785	N.A.	Pass	N.A.
9	1332 keV Efficiency	8.426E-03	N.A.	Pass	N.A.

Q.C. Results Saved.

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Gamma Spectrometer Calibration Log

Date: 1-2-09

Reviewed By/Date: date 1-2-09

Det. No.	Out Of Service	Background		Source Check			Repeat Source Check			
		Started	OK	Started	OK	Failed Parameter(s)	OK	Failed Parameter(s)	Corrective Action Taken **	Removed from Service
1.	<u>use</u>			/	/					
2.				<u>use</u>	<u>use</u>					
3.				↓	/	1332 keV Centroid	0 <u>use</u>		Gain Adj.	
4.				↓	/	662 keV FWHM	<u>use</u>			
5.	<u>use</u>			/	/					
6.				<u>use</u>	<u>use</u>					
7.				↓	↓					
8.	<u>use</u>			↓	/	1332 keV FWHM	<u>use</u>			
9.				↓	/	60 keV FWHM	↓			
10.	<u>use</u>			↓	<u>use</u>					

** Corrective Action:

0 Run a second daily check due to gain shift in a sample count.
use 12-09

SEEKER D E T E C T O R Q . C . A N A L Y S I S Version 2.2.2

ID: DAILY CHECK

Detector # 7 Detector Q.C. Analysis for 01/02/2009 08:43:33

Standards File #: 97 (Daily Performance Check(S SOURCES 1-12))

#	Parameter	Value	n Sigma Test	Bounds Test	T- Test
1	60 keV Centroid	121.201	N.A.	Pass	N.A.
2	60 keV FWHM	9.320E-01	N.A.	Pass	N.A.
3	60 keV Efficiency	1.426E-02	N.A.	Pass	N.A.
4	662 keV Centroid	1323.952	N.A.	Pass	N.A.
5	662 keV FWHM	1.741	N.A.	Pass	N.A.
6	662 keV Efficiency	1.577E-02	N.A.	Pass	N.A.
7	1332 keV Centroid	2662.514	N.A.	Pass	N.A.
8	1332 keV FWHM	2.719	N.A.	Pass	N.A.
9	1332 keV Efficiency	8.815E-03	N.A.	Pass	N.A.

Q.C. Results Saved.